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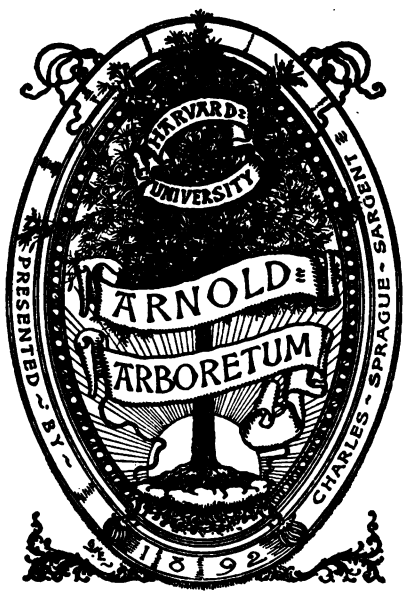

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1941

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TERRITORY OF HAWAII—

REPORT

OF THE

Commissioner of Agriculture

AND FORESTRY

FOR THE

YEAR ENDING DECEMBER 31ST

1900

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HONOLULU:
HAWAIIAN GAZETTE CO., LTD., PRINT
1901

REPORT

OF THE

Commissioner of Agriculture and Forestry.

HONOLULU, T. H., December 31, 1900.

HIS EXCELLENCY SANFORD B. DOLE,

Governor, Territory of Hawaii.

SIR:—I have the honor to submit the following report of the Commissioner of Agriculture and Forestry for the year ending December 31, 1900. During the early part of the period, in fact up to June 13, the Board of Agriculture with its Secretary was in existence. On June 14 the "Act to Provide a Government for the Territory of Hawaii" did away with the Board, the Bureau and Commissioners, all being absorbed by a Commissioner of Agriculture and Forestry; and to which position I was honored by your Commission on July 1st. The following day Mr. David Haughs was appointed Chief Forester.

At the latter end of July in answer to a request, I had the pleasure of forwarding to Mr. Gifford Pinchot,

Forester U. S. Department of Agriculture, a set of fifty photographs illustrating the Hawaiian forest growth, and other scenery, with a description of each picture, and which were acknowledged with thanks, and a set promised illustrating American forests. As this office is visited by numbers of tourists and steamer passengers, I set apart a room, and have made a collection of Hawaiian fruits in preservative, forest and other scenes, varieties of sugar cane, Hawaiian rice, fishes, seeds, shells, etc., and it seems to be quite attractive. I intend to add island woods, our different coffees and volcanic specimens. There are also a large number of books, pamphlets, etc., for reference for the general public, embracing many agricultural subjects.

The U. S. Department of Agriculture at Washington has been extremely thoughtful of this department in sending seeds, plants, etc., for general distribution among the islands. At various times we have received large consignments of different varieties of sorghum, white lupin, Egyptian Cotton, cowpea, jute, Daikon radish, muskmelon, etc. There was a large demand for the seeds and they were given away to those whom we know would plant them and give them careful attention, and further, report on them. Much difficulty has been experienced in getting people to plant some of these seeds. Take for instance the Lupin, it was well advertised that the department had it to give away, but the inquiries were only few. The Department at Washington were very anxious we should give it a trial as well as the Egyptian cotton. If the same interest taken in the cultivation of sugar cane could be extended to a few new in-

dustries, there would be a marked change in the agricultural prospects here. A consignment of kola seeds did not arrive in live condition.

The visit of Dr. William C. Stubbs, Director of the Louisiana Experiment Station, to Honolulu in July, was an important event in the agricultural history of Hawaii, coming as he did with instructions from the Honorable Secretary of Agriculture at Washington, to investigate the agricultural conditions in the islands with special reference to the establishment of an agricultural experiment station. Dr. Stubbs made only a brief stay but during that time, he consulted with representative residents of the islands prominently identified with the agricultural interests; and your Commissioner did everything possible to assist Dr. Stubbs in obtaining the desired information. In September, I received a letter from Dr. Stubbs in which he stated he had made his report to the President and Secretary recommending that an Experiment Station be located on the plat assigned by the Board of Agriculture in 1893 as a site for an Experiment Station. This tract containing about 222 acres, starts from behind Honolulu running up the Makiki Valley to an elevation of over a thousand feet. It is known as Kewalo-uka. The Doctor further stated he had recommended a Director be appointed. That done, he would take charge at once; clear the grounds, erect the buildings and get ready for the remainder of his staff. He further recommended that the Governor, Commissioner of Public Lands, and Commissioner of Agriculture and Forestry be an Advisory Council to the Director. Up to the end of the period nothing further had been done.

The Board of Agriculture in 1893 did something towards starting an experiment station on a small scale, but nothing came of it, although money was appropriated for the work.

It is admitted that general prosperity depends absolutely upon agricultural prosperity. Director True is responsible for the statement "that an agricultural experiment station is an institution in which scientific and practical investigations are made with a view to improving the methods of introducing new crops or industries. The primary object of an experiment station is to apply scientific principles and methods to the problems of agriculture. It seeks to use for the benefit of agriculture the stores of knowledge regarding the operations of nature which science has accumulated, and to employ in the service of agriculture the trained brains and hands of scientists. The experiment station should institute investigations to increase accurate information regarding the great principles which underlie the growth of plants and animals, and to make new applications of well-known principles in the practical work of the farmer." That the establishment of this experiment station, long needed here, will be a boon to the agricultural interests of the Territory goes without saying. Once started, and in running order, the agricultural developments of the islands will make rapid advancement.

Dr. John G. Jones, Adviser to the Agricultural Department, Japan, was a visitor at this office on two occasions, and was kind enough to send us forest tree seeds and dry land rice from that country. A number of Japanese interested in agriculture in their own country called in to obtain information. We have also had many

visitors from the States, Canada, England and the Australian Colonies.

GOVERNMENT NURSERY.

Considerable improvement has been made at the Government Nursery on King street. A new fence has been built entirely around the grounds and necessary repairs have been made to the house. It is from here that the distribution of plants, palms, shade and wind break trees is made to the general public, and for the beautifying of the Government School grounds. That this free distribution is a boon to the community is shown by the number distributed. By first obtaining an order from the office, the bearer is entitled to one, two, three, or more dozen of selected plants on condition that they are planted and well taken care of. A large number of new building lots have been opened out during the year, in and around Honolulu, and the Government, through its Nursery, has been able to assist people in beautifying them with trees and plants which are most suited to this tropical clime. Plants and trees have also been sent to the other islands. During the year the distribution has been as follows:

January	513
February	1,920
March	1,731
April	2,751
May	3,182
June	1,612
July	562
August	2,760

September	2,208
October	3,576
November	2,819
December	910
Total	24,544

In addition to the above number 26,000 suitable forest trees have been propagated and sent up to the Nuuanu Forest Station and then planted out. There is now in the Government Nursery for distribution the following number and varieties of trees and plants:

100 ACHRAS SAPOTA—Sapota Pear.
300 ADENANTHERA PAVONIA—Red Sandalwood.
120 ALBIZZIA LEBBEK—Siris Tree.
200 ANACARDIUM OCCIDENTALE—Cashew Nut.
130 ANONA SQUAMOSA—Sweet Sop, Custard Apple.
100 ANONA MURICATA—Sour Sop, Custard Apple.
100 AVERRHOA CARAMBOLA—Caramba Tree.
70 BARRINGTONIA SPECIOSA—Suitable for Sea Beach.
50 BAUHINIA ACUMINATA—White Flowering.
100 BAUHINIA TOMENTOSA—St. Thomas Tree.
40 BIGNONIA TWEEDIANA—Vine, Yellow Flowering.
50 BOMBAX CEIBA—Silk Cotton Tree.
364 BRACHYCHITON ACERIFOLIUM—Australian Flame Tree.
50 BRUNFELSIA CONFERTIFLORA — Shrub, Blue Flowers.
50 CAESALPINIA SPS.—Yellow Flowering Tree.

150 CAESALPINIA SAPPAN—Red Dyewood.
130 CARICA PAPAYA—Papaya Tree.
30 CASSIA FISTULA—Golden Shower.
30 CASSIA GRANDIS—Pink Flowering Tree.
100 CASSIA NODOSA—Pink and White Flowering.
800 CASUARINA EQUISTIFOLIA—Ironwood.
150 CHRYSOPHYLLUM SPS.—Ornamental Shade Tree.
3000 CITRUS LIMETTA—Lime Tree.
900 CITRUS JAPONICA—Kumquat.
30 CLEMATIS ALBA—Vine.
100 COFFE ARABICA—Arabian Coffee.
50 COFFEE LIBERICA—Liberian Coffee.
180 CORDIA SUBCORDATA—Kou Tree.
30 CRESCENTIA CUJETE—Calabash Tree.
50 DRACAENA DRACO—Dragon Tree.
578 DURANTA PLUMIERI—Shrub, Blue Flowers.
30 EUCALYPTUS CITRIODORA—Lemon Gum.
180 EUCALYPTUS ROBUSTA—Swamp Mahogany.
3000 EUGENIA JAMBOLANA—Java Plum.
50 EUGENIA JAMBOSA—Rose Apple.
80 FICUS SPS. From Ceylon.
20 FICUS MACROPHYLLA—Rubber Bearing Tree.
3000 GREVILLEA ROBUSTA—Australian Silk Oak.
50 HAEMATOXYLON CAMPECHIANUM — Logwood Tree.
20 HEVEA BRAZILIENSIS—Para Rubber.
50 LAURUS CAMPHORA—Camphor Tree.
30 LAGERSTROMIA REGINAE—Indian Bloodwood.
40 LIGUSTRUM VULGARE—Privet Hedge Plant.
100 LINOCIERA RAMIFLORA—Ornamental Tree.

100 MACADAMIA TERNIFOLIA—Nut Tree.
600 MANGIFERA INDICA—Mango, Jamaica No. 9.
100 MANGIFERA INDICA—Mango, Jamaica No. 7.
125 MORINDA CITRIFOLIA—Rubber Bearing Vine.
370 MURRAYA EXOTICA—Mock Orange.
100 OCHROSIA SANDWICENSIS—Native Name, Hoolei.
300 PARKIA AFRICANA—African Locust Tree.
400 PASSIFLORA SPS.—Purple Flowering Vine.
20 PASSIFLORA QUADRANGULARIS—Granadilla Vine.
80 PHYLLANTHUS ROSEO-PICTUS—Shrub.
130 PITHECOLOBIUM DULCE—Curl Bush Bean.
300 POINCIANA REGIS—Rich Crimson Flowers.
50 PROSOPIS DULCIS—Algaroba.
4000 PSIDIUM CATTLEYANUM—Strawberry Guava.
300 PSIDIUM GUAIAVA—Lemon Guava.
100 SAPINDUS SAPONARIA—Soap Tree.
100 SARACA INDICA—Shrub, Orange Flowers.
50 SCHINUS MOLLE—Pepper Tree.
180 STEPHANOTIS FLORIBUNDA—Vine.
12 STERCULIS ACUMINATA—Red Kola Nut.
275 TAMARINDUS INDICA—Tamarind Tree.
90 TECOMA STANS—Trailing Shrub.
12 TECTONTA GRANDIS—Teak Tree.
48 TERMINALIA CATAPPA—Tropical Almond.
8 TERMINALIA SPS. From Fiji.
50 THEVETIA NERIIFOLIA—Yellow Oleander.
100 THEOBROMA CACAO—Chocolate Tree.
30 VANGUERIA EDULIS—Fruit Tree from Fiji.

PALMS.

75 ARECA RUBRA—Red Palm, Madagascar.
700 BRAHEA FILAMENTOSA—Lower California.
25 CARYOTA URENS—Wine or Toddy palm. Ceylon and India.
325 COCOS PLUMOSA—Southern Brazil.
20 CHAMAEDOREA GRACILIS—Tropical America.
80 ELAEIS GUINEENSIS—Oil Palm, Guinea.
30 HPOPHORBE AMARICAULIS—Mauritus.
1068 KENTIA MACAURTHURII—South Sea Islands.
1275 LATANIA BORBONICA—Bourbon.
1420 LIVISTONA ROTUNDIFOLIA—East Indies.
1345 OREODOXA REGIA—Royal Palm, Cuba.
15 OREODOXA OLERACEA—West Indies.
170 PHOENIX DACTYLIFERA—Date Palm, North Africa.
50 PHOENIX RECLINATA—South Africa.
875 PRITCHARDIA GAUDICHAUDII—Hawaiian Islands.
50 PRITCHARDIA PACIFICA—Fiji Islands.
500 PTYCHOSPERMA ALEXANDRAE—Queensland.
150 SEAFORTHIA ELEGANS—East Australia.
20 SABAL BLACKBURNIANA—Bermuda.
2362 THRINAX ARGENTEA—Florida.

NUUANU FOREST STATION.

This Station situated in Nuuanu Valley about a mile below the famous Pali, is in charge of G. H. Moore, Forester, who has a working force of only five laborers.

During the year they planted out 30,203 trees, comprising Acacia Koa, Acacia Melanoxylon, Blackwood of Australia, Silk Cotton tree, Ironwood, several varieties, Java Plum, Silk Oak, Eucalyptus, several varieties, Ficus Macrophylla, rubber bearing tree, Pride of India, Syncarpia Laurifolia, Terminalis Arjuna and Catappa, Afzelia Bijugate, etc. Since the work of foresting the upper part of Nuuanu commenced the latter end of 1897, the number of trees planted out and cared for has been 109,960. But with only five men, the work has not progressed so fast as it should have done. I would recommend that a force of fifteen men be maintained at the Station, and that additional quarters be built to accommodate them. Strict measures have had to be taken to prevent people trespassing on the lands and doing damage to the young trees, in some instances pulling them up and carrying them away. Notices have been posted in conspicuous places, and the trespassing has in consequence decreased.

MAKIKI FOREST STATION.

This forest is looked after by one man who lives all alone at the station. He has to keep the trails clean, to look out for fires and see that no damage is done to the trees which have been planted by the Government. There are a number of fruit trees he has to care for. Fortunately, during the year, there was only one fire started, and this was put out by the keeper before it could make any headway. Some necessary thinning out has been done which has its advantage. There has been a tremendous increase in the travel up Tantalus forest, the name it is more generally known by. Tourists are

delighted with the drive up Tantalus, the road is good, climate delightful, and the scenery unsurpassed. Several years ago when this station was established for foresting Tantalus, a cottage for the Forester and quarters for the laborers were built. Upon investigation and looking over the survey, I was surprised to find that these buildings are on the Coney estate. However, by arrangement, our keeper is allowed to remain in his quarters, but I ask for an appropriation for building suitable quarters, and a shed, for him and an additional laborer on the Government land. The forest must be well looked after and I believe that can be done better by two men than one. The list of trees growing in this forest is quite a lengthy one. None of them have as yet arrived at maturity, as regards the timber quality; it will be several years before they do that. Hundreds of exotic forest trees have been experimented with, and given a fair trial in the forest, but without success. Seeds have been received from the Southern States, Cape of Good Hope, Ceylon, Australian Colonies, China and Japan. The trees from Australia have proved to be the most successful. It has been suggested that more useful trees ought to have been planted in the forest. Those planted will all be useful when they arrive at maturity. Will more trees grow there? that is the question to solve. Following are some of the many trees growing in Makiki with a brief description:

ACACIA DEALBATA—Silver Wattle. This tree grows to a height of 150 feet supplying a clear and tough timber used by coopers and other artisans; but principally serving as fuel of great heating power. From the

tiny split wood, elegant baskets can be made. It is a fast growing tree.

ACACIA DECURRENS—Black Wattle. The wood of this tree is used for axe and pick handles, its bark is rich in tannin, and its gum something like gum arabic. These trees are growing well, being now from twenty-five to thirty feet high.

ACACIA MELANOXYLON—Australian Blackwood. A tree that attains a height of eighty feet. The wood is valuable for furniture, railroad cars and carriages, boat building, tool handles, billiard tables, piano sound boards, etc. The bark contains 20 per cent of Mimosa tannin. It is one of the best for forest planting.

ALBIZZIA LEBBEK—A fine shade tree, highly recommended by Mr. D. G. Fairchild, Agricultural Explorer for the U. S. Department of Agriculture, who saw it in Egypt. From Southern California and Florida, to be used along the streets and roads. It grows well here.

ALBIZZIA SAMAN—Monkey Pod. The lower part of the forest is mostly planted with this tree. They have not grown here to any size, but in town there are a number of immense trees, most invaluable for shade.

CAMPHORA OFFICINARUM—Camphor tree. Several hundred were planted about six years ago, and they now range from a height of three to six feet. It produces the Camphor of Commerce, and is a great industry in China, Japan, Formosa and Ceylon.

CALOPHYLLUM—Inophyllum. An East Indian and Malayan tree with a trunk ten to twelve feet in diameter, and from eighty to a hundred feet high. The seeds yield a thick, dark green scented oil, used for medicinal purposes. Masts and spars are made from the wood.

CASUARINA EQUISTIFOLIA—Ironwood. Reaches a height of 150 feet and a fine forest tree in every way. The timber is tough, nicely marked, and much used for piles or jetties, posts, tool handles, etc. A large number are growing well at the head of Nuuanu Valley.

CASUARINA GLAUCA—A rapid grower. Its hard durable wood is valuable, used for staves, shingles, etc.

CUPRESSUS MACROCARPIA—Monterey Cypress. A beautiful shade tree, growing to a height of 150 feet, with a stem 9 feet in circumference.

CRYPTOMERIA JAPONICA—Japanese Cedar. It yields timber scented like that of the Cedrela. The wood is durable, compact, soft and easy to work. A number were planted six years ago and are doing well in sheltered places. Makes a nice ornamental hedge.

EUCALYPTUS—The majority of the trees in this forest are of this family. For its medicinal qualities the Eucalyptus has been a boon to the world at large.

GREVILLEA ROBUSTA—Silk Oak. A tree of rapid growth, resisting drought in a remarkable degree. A splendid wind break tree. The wood is elastic and durable. One of the most eligible trees for desert culture.

PINUS INSIGNIS—Monterey Pine. One of the few pines that seem to thrive in the islands at a low altitude. It does not thrive well enough to warrant a general planting as a forest tree. The wood is of inferior technic value, but the tree can be utilized for obtaining tar and pitch.

SYNCARPIA LAURIFOLIA — Turpentine tree. Grows to a height of 200 feet, with a stem 30 feet in girth. Wood is durable, used for flooring and cabinet making, taking a high polish.

TERMINALIA CATAPPA—Tropical Almond. Grown for shade and ornamental purposes.

EXPERT FORESTER AND FOREST WORK.

Application has been made to the U. S. Department of Agriculture, Division of Forestry, to send out an expert forester to investigate and make a report on the forests in this Territory. Mr. Gifford Pinchot, the head of the Forestry Division, in writing on the subject at the latter end of the period states that the work of a forester here would be first of all to acquaint himself with the conditions, and that considerable time would be required for study. He was not able to say when he would be able to send a trained man. Dr. Stubbs, when in Washington, had some conversation with Secretary Wilson on this subject. There are many very important matters here touching on the Forestry question, which, in a measure, require the experience of a trained forester.

Anticipating the visit of this expert has somewhat interfered with my intention regarding forest work. I believe with Dr. Maxwell that "forest areas reserved with respect to location and maintained in a state of vigor and sound growth are of the first importance to the agriculture of the Territory. The greater number of the sugar plantations and all of the rice and banana fields are depending upon an elaborate and costly system of irrigation for their water supply, and the operation and availability of the irrigating waters are largely depending upon the area and state of the forests upon the mountain altitudes. It is not only claimed that cool forest covers cause precipitation of rain, but that the thick undergrowth and brush assist in conserving the water and

in preventing its precipitous discharge to the sea, which conditions are indispensable in maintaining a regular supply of water for distribution over lower lands. Efforts have been made to restore the forest where it has been killed out. Several of these individual efforts have not only resulted in great benefit to the localities where the experiments have been made, but they are serving as object lessons, showing the immediate need of inclosing given forest areas and defending them against the action of cattle, thus following the depleted undergrowth and trees to come up again, a result which has followed in every case where inclosure has been adopted. Local efforts, however, do not meet the demands of the forest question from the standpoint of the interests of the Territory as a whole. What appears to be the most immediate needs are a thorough expert examination of the different islands and of their requirements in permanent forest areas, an inspection of the existing forests, and the adoption of means for improvement and maintenance. It may be possible for such an expert survey to show that portions of lands still under forest could be cleared for cropping without prejudice to the immediate or to distant localities, and, on the other hand, to indicate that the disturbance of existing forest areas in given locations would result in detriment to agriculture all around. Because of its bearing upon the immediate and permanent interests of agriculture, there is no question which demands at once a more careful and expert investigation than the state of these Territorial forests."

Had I known the expert forester was not likely to be here before the period closed, I would have sent our Chief Forester to examine all the forests on the different

islands and report thereon. The work in Nuuanu forest progresses slow with only five laborers. With a larger number—fifteen is asked for—the work would proceed faster. At different intervals, say six of these laborers could be sent to the other islands with thousands of young trees, and plant them in localities where most needed, under the direction of the Chief Forester. The propagation of young forest and shade trees at the Government Nursery is now carried out on a much larger scale than heretofore. More seeds also are being collected and sent for.

This department has the care of Thomas and Emma squares, and is also to look after Makiki and River Parks when they are opened out. It is intended to make considerable improvement at Thomas square, and turn it into a public square; indeed, the work is already begun by the removal of every croton and hibiscus bush from the place. Some time ago the hibiscus hedge around the square was removed. The square is surrounded by a concrete sidewalk; between this and the curbstone grass will be planted. The entire square is to be graded, and much tree thinning undertaken. Several of those fine shade trees, the Poinciana Regia and Golden Shower, will be planted in the square, which, when in blossom, with the green foliage, will make a picturesque scene.

Your Commissioner has authority to establish and carry out an Arbor Day. A day towards the end of September would be the best time, as what was planted would get the benefit of the rainy season following. The idea of tree planting by school children would cultivate botanical taste among them, besides giving them pleasure. Plans will be laid out several months ahead of

time with a view to carrying out Arbor Day. One idea, I think of, is to have the entire front of Punchbowl planted with pepper trees, as it sadly needs some kind of vegetation. The pepper tree will do well there.

In September, I requested Chief Forester Haughs to proceed to the Island of Maui and make a report on the forests around Haiku and a part of Haleakala. Excellent work has been done there by Hon. H. P. Baldwin, and if the Territory had a few more such public spirited men, there would be a wonderful improvement in forestry work. Mr. Haugh's report will be found attached, marked "REPORT No. 1."

On the 2d of July, the Commissioner of Public Lands wrote that the Portuguese Sugar Mill Company of Hilo had asked for permission to clear a certain portion of the land of Piihonua, Hilo, Hawaii, and for the further use of water from said land for mill and fluming purposes. As this matter affected the forests, Dr. Walter Maxwell, director of the Hawaiian Planters' Experiment Station, was requested by the Governor to visit Piihonua and report on the advisability of allowing the said lands to be cleared and used in cane culture. In the early part of August I accompanied Dr. Maxwell to Hilo, and we visited the lands of Piihonua very thoroughly. The report of Dr. Maxwell is attached, marked "REPORT No. 2."

GOVERNMENT ENTOMOLOGIST.

During the early part of the year, Professor Albert Koebele, our entomologist, was in the Australian Colonies and South Sea Islands. His regular report is attached, marked "REPORT No. 3." While in the Australian Colonies he discovered a maggot fly that affected

the fruits, and from that information steps were at once taken prohibiting the importation of any fruits whatsoever from the Australian Colonies and South Sea Islands. This worked rather a hardship on importers of limes, for several dozen cases were thrown overboard, immediately on arrival at this port. All plants coming into the Territory are thoroughly inspected, and no soil is allowed "to land." We have enough pests without having any more introduced. Still, I must say the excellent work done by our entomologist in the past is bearing fruit, for insect pests are not half so numerous as they were.

The Japanese beetle ADORETUS UMBROSUS, I am sorry to say, is still with us. Professor Koebele found a vegetable fungus, which if the beetle comes in contact with is sure death. Inoculated beetles have been distributed with printed instructions how to breed the fungoid, but there has not been enough interest taken in the work by those who are troubled with this pest. In Honolulu, there is certainly a large decrease in the beetle.

Complaints having come in from Mr. E. P. Low on the depredation of insects on the forest trees at Puuwaawaa, Hawaii, I asked Professor Koebele to visit that section, which he did in September. His report is attached, marked "REPORT No. 4."

Insects having been noticed affecting the koa trees in the Haiku forest, Maui, Professor Koebele visited there, his report being attached, marked "REPORT No. 5."

DIVERSIFIED INDUSTRIES.

Encouraging reports come in from the American colony at Wahiawa, about twelve miles from Pearl City. They are settled on about fifeen hundred acres. There are fifty-three white residents in the colony. About four hundred acres have been plowed, part of it a second time. Something over fourteen hundred orange trees are planted in orchard, and several thousand more are on the ground ready to be planted. No less than 3,500 bananas are planted, and about 35,000 pines, with 20,000 more plants now in course of planting. In the orchard are 100 fig, 100 olive, 100 mango and pear, and 100 peach trees. Several thousand peach trees have been ordered from Florida, for which the ground is now being prepared. As soon as they arrive they will at once be planted. Last spring 5,000 grape vines of six leading California varieties were planted, but the cut worms and beetles got away with nearly all of them. Some more are to be planted this winter. In vegetables, the colony grow corn, tomatoes, cabbage, peas, string beans, sweet potatoes, beets, peppers, also watermelons, and all are of unsurpassed quality, but as yet only grown in small quantities, somewhat in an experimental way. Next year more will be raised, especially if the colony get the water for irrigation. Wheat, oats and barley are being tried; also, blackberries, raspberries and strawberries. About a couple of acres have been planted with sugar cane, but it is sincerely hoped the colony will not give up their fruit and vegetable raising and go in for sugar, like the Olaa people did with their coffee. We need a better quality of vegetables than what the Chinese can

raise, and this colony can do it, and should receive every possible encouragement. The climate at Wahiawa is a perfect one, and the scenery around picturesque.

About three months ago, Mr. R. H. Long, a produce merchant in San Francisco, arrived in the Islands with the idea of going extensively in the vegetable raising business. For several years past he has shipped produce to the Islands, but there is no doubt that the fruits and vegetables coming in cold storage lose much of their flavor. Mr. Long looked around and finally obtained thirteen acres of land in Waimea, Hawaii, at an elevation of 2,800 feet, where, under the direction of an expert Italian gardener, he has growing, cauliflower, cabbage, celery, tomatoes, beans, turnips, peas, corn, beets, parsnips and rhubarb. It will not be long before he will be ready to supply an unlimited quantity, as well as a fine quality of the above vegetables.

At Kaneohe, over the Pali, Mr. C. Koelling has a castor bean plantation, and a mill fitted up with the best of machinery, and is very busy manufacturing castor oil, said to be a very good article. Near by Carl Tuchs is occupied in raising peanuts, which he sends to the Honolulu market, meeting with ready sale. He also grows upland rice.

Great progress has been made by the Hawaiian Fiber Company, located near Ewa Mill on the line of the Oahu Railway. The company started on the 10th of December, 1898, and now has 405 acres planted in sisal, and enough plants in the nursery for ten acres more. It was calculated when the industry started that at the end of two years, the company would have 416 acres planted, which shows some very close figuring. About 250,000

plants have been set out. They were obtained from the Ewa Plantation Company, but originally came from the Bahamas. By the end of 1901, machinery will be placed in position to take off 140 acres which will be ready by that time. Fourteen men, besides the manager, are employed in this work, which promises much success.

I would call the attention of those who are interested in horticulture and agriculture, and urge on them to pay a visit to the country residence of Mr. S. M. Damon at Moanalua. This gentleman has spent thousands of dollars in improving his grounds and obtaining the rarest kinds of fruits and ornamental plants. A more magnificent collection of orchids could not be seen this side of the Rocky Mountains. The orchid house contains over three hundred different species, more than can be seen in the Golden Gate Park conservatory, San Francisco. There is also a rose house and several green-houses, where the work of propagating goes on, all under the direction of Mr. Donald McIntyre, who is always very courteous to visitors. Some of the finest varieties of mangoes are being grown there, also a number of varieties of bananas and figs, papaias, avocado pears, etc. At the present time globe artichokes are being tried. Moanalua, in a measure, is an experimental garden, gradually, but surely drifting into what its owner at first contemplated, a botanical garden.

For a practical illustration of farming where attention is paid to every detail, mention must be made of the Waialae ranch, near Honolulu, and of which Mr. P. D. R. Isenberg is owner. He superintends everything himself, being deeply interested in agricultural matters. Here may be found growing finely in large quantities,

many varieties of sorghum, alfalfa and other forage plants, besides grasses. No finer stock than that of Mr. Isenberg's is seen anywhere on the Islands.

In Nuuanu Valley at an elevation of 600 feet, Mr. E. Henriques is growing rhubarb, onions, egg tomatoes, beans, carrots, turnips, cabbage, lettuce, beets, all of the very best quality. It may be said that almost anything will grow on the Islands.

Inquiries by letter have come from all parts of the world for information regarding seeds, plants and fruits, also as to new industries. These have been carefully answered, for until an experiment station is started it would not be right to give encouragement in any line of new industry to these Islands, without first knowing whether it would be likely to prove a success. A consignment of alfalfa seed is expected to arrive early in 1901. There is a large demand for it.

Several complaints have come in as to the impoverished state of the taro in some localities. Some disease seems to have attacked the roots, making them unfit for food. Specimens were obtained by our entomologist, who examined them, then sent them on to Washington, and we are now awaiting a reply from the Department of Agriculture there. I have written, to try and obtain varieties of taro other than what are grown here. Silk worm culture is mentioned by Professor Koebele in his report.

Many inquiries have been made verbally and by letters as to whether tobacco will do well in the Islands. There is no doubt that tobacco will grow well here, as it has been grown, but the trouble is the curing, which has never been properly tried. At Olaa, tobacco is growing finely

from seeds sent for, from Turkey, but it is only grown more in an experimental way. The natives grow their own tobacco, merely dry it and use it.

Another industry that could be gone into, and possibly with much success, is the cultivation of vanilla, as it grows well here.

By law the Commissioner of Agriculture and Forestry may authorize fairs to be held from time to time in Honolulu for the exhibition of agricultural products, and provide competitive prizes for excellence in such products. It is my intention, if the Legislature will make an appropriation, to hold such a fair towards the latter end of the month of July, as at that time a larger variety of fruits could be obtained, and in consequence a more interesting exhibition. Prizes of a suitable nature could be offered for the best collection of avocada pears, bananas, eugenias, figs, grapes, guavas, limes, mangoes, musk and watermelons, oranges, papaias, pineapples and strawberries. Also prizes for taro, sweet potatoes, yams, and say the best ten sticks of sugar cane. There should be a prize for the best collection of vegetables, raised in the Islands, and also prizes for the best collection of palms, cut flowers and wild flowers.

RUBBER INDUSTRY.

The question of rubber cultivation has been a very live one for some time in the Territory. Some seven years ago this department imported a quantity of the seeds of the MANIHOT GLAZIOVII, Ceara rubber, and distributed them to numerous people in the Islands. Samples were also sent to the Makiki forest. The seeds germinated in from six weeks to two months, the young plants

grew up, being planted in a sheltered part of the forest. They grew very well and some are now bearing seeds. At that time the accounts of Ceara rubber in the Ceylon papers led people to believe that fortunes could be made out of the cultivation of rubber in a few years, and a large number planted hundreds of acres in Ceylon. After experiments had been made, it was found that the tree did not produce rubber enough to pay for tapping and manufacturing.

The HEVEA BRAZILIENSIS, Para rubber, has been tried here, and in two years a number of these plants were distributed from the nursery. Reports have come in that some of the trees are growing slowly, from others that they do not seem to thrive, and that most of them are dead. In August, we received a case of the Hevea seed from Brazil. The majority of the seeds were not in a live condition. Experiments were made, but only about half a dozen of the seeds came up, and they looked as if they were ready to die. Our entomologist examined them and reported that large numbers were perforated with holes from where injurious insects had issued after devouring the whole or part of the interior. Others, again, having those perforations were full of an ACHARED living upon the remains of the kernel. All these were picked out and burned, the rest being placed in lime water. Afterwards all were planted, with the result above stated.

The best rubber tree, and the one that is being almost universally planted, is the CASTILLOA ELASTICA (Panama or Nicaragua rubber). This tree, as far as can be learned, has not been tried on these Islands. I am, at present, in correspondence with firms in Ceylon and

London, for the purpose of obtaining a consignment of the CASTILLOA plants. There is reason to believe that this tree would do very well in some localities here. In Tobago, West Indies, the CASTILLOA does remarkably well. One tree there eight years old, measures five feet in girth, at three feet from the ground, and another of the same age measures four feet and ten inches. From a tree tapped lightly, on three different occasions, at a week's interval, a half pound of rubber was obtained. Cacao and coffee bear well under the shade of the CASTILLOA. In Costa Rica the CASTILLOA is a hardier plant than most rubber trees, needs very little weeding after the first year. The bulk of the world's supply of rubber, at the present time, is being obtained from trees growing in their natural forests, and the trees may be all the way from 50 to 100 years old, or probably older. What the results will be if the trees are tapped at the age of eight years, and continued every year, remains to be seen. While seven years is usually mentioned as the earliest age at which the CASTILLOA ELASTICA may be tapped, there is rubber in the plants from their very beginning. Doubtless the longer tapping is delayed the greater will be the yearly yield, and the longer the life of the trees. At the same time conditions may exist under which rubber may be gathered at an earlier age, and the high prices might make it profitable to bleed the trees freely, even at the risk of shortening their life. The rubber tree which has been mentioned as growing in these Islands, is undoubtedly the CEARA rubber, and which has been discarded as unprofitable in rubber bearing countries. As the CEARA rubber is of no use as a timber tree, it is fortunate that there was not a

general planting of it here when the boom was on in Ceylon. Every effort will be made by your commissioner to further this industry, as well as many others, which are occupying his close attention.

Respectfully submitted,

WRAY TAYLOR,
Commissioner of Agriculture and Forestry.

(REPORT No.1.)

REPORT OF CHIEF FORESTER HAUGHS ON MAUI FORESTS.

Honolulu, September 19, 1900.

WRAY TAYLOR, ESQ.,

Commissioner of Agriculture and Forestry.

Sir—I have the honor to submit the following report in regard to my recent visit to the Island of Maui. The object was to examine and report on the condition of the forests around Haiku and part of Haleakala. I spent four days on the Island, commencing with the forests around Haiku, and examined the young trees recently planted by the Hon. H. P. Baldwin, consisting of Eucalyptus, Casuarina, Grevillea robusta and several species of Acacia, all of which are growing well. The Eucalyptus globulus (blue gum) proves to be the fastest grower in that district.

Mr. Baldwin informed me that during the past three years he had planted and distributed to people in the district about 200,000 trees, and he also stated that he intended to continue the work at the rate of from 50,000 to 60,000 trees a year. Mr. Baldwin has driven out the stock and fenced in several thousand acres of land on the Haiku ranch, and has commenced to reforest the same, with the object of retaining the whole tract as a forest reservation.

Mr. James Lindsay, the forester who has had charge of the planting of the trees mentioned, says he has had a number of his trees destroyed by what is called the "Olinda beetle" and other pests.

Along with Mr. Lindsay and Mr. Aiken we visited a tract of forest land adjoining Mr. Baldwin's reservation belonging to the Board of Education. This land, I am told, is leased to the Haleakala Ranch Company, and formerly used by that concern for grazing purposes. During the year 1895 the ranch company drove out their stock and fenced the tract and offered to transfer the same to the Government as a forest reservation. I am not clear as to the conditions the ranch company made in regard to the transfer, but I am informed that the Government refused to accept it. Since then I am told there has been no stock allowed on this tract. With the exception of a number of koa trees that have been killed by pests, the forest is in fairly good condition, and the underbrush is beginning to grow where formerly it used to be barren. The Haleakala Ranch Company still has control of this land, and there is nothing to prevent them, should they feel inclined, to again turn in their stock and destroy the work that is being built up by nature for the benefit of mankind.

The great amount of fertile land makai of this and lying with a gradual slope toward the Hamakuapoko and Paia plantations, that could be used for farming were the water supply sufficient, makes it almost criminal to neglect such a spot as this. I would strongly recommend that the Government take steps to get control of this land and appoint a resident of the district to see that the stock is kept out and the fences kept in

good repair. I would also go further and ask the Government to spend a few hundred dollars reforesting part of the tract that has become denuded. That, alone, would encourage such men as the Hon. H. P. Baldwin, who are doing so much for the benefit of the whole community, and show that the Government is ready and willing to assist in the preservation of the forests.

I also visited the beautiful valley of Iao, accompanied by Mr. Taylor, the Government surveyor, who has just finished laying a pipe and making a reservoir for the Government, for the purpose of supplying the town of Wailuku with water. We examined the forest around the springs, and found it in a healthy condition, and no appearance of stock of any kind. The trees in this valley are mostly kukui and ohia, with a few koa.

In recommending the fencing and planting of portions of our mountain lands to be used as forest reservations, we may briefly consider what the forests may be expected to do for us in the future. First of all, let us consider the relation of forests to our water supply, and the reason for reserving such lands. It is a well known fact that forests restrain the destructive force of surface water, and thereby give it a better chance to soak into and saturate the adjacent earth. The downward pointing of roots of most trees, especially the larger ones, penetrate the earth to a great depth, and loosen the soil sufficiently to allow the water to find its way to the depths beneath, where it is safe from immediate evaporation, and where it continues possibly for months to fill the smaller streams and maintain the perpetual flow of our springs. The increased rapidity with which water drains out of a treeless country, carrying with it the best soil of our

fields, which it is almost impossible to restore, is one of the most important elements in agricultural prosperity. Just how great the volume of this fertile soil wash is, few persons have any idea of unless it in some way becomes conspicuous by its unusual amount, or by becoming a nuisance on our streets and roads. However, the greater and most fertile part of it is carried by the swift flow of the streams out to sea. The planting of trees for fuel where so much coal is at present being used, around the mills and pumps of our large plantations, is well worth the consideration of the agents and plantation managers.

A great deal more could be said in regard to the benefits of forests to the community at large, but enough has been proven to justify that the protecting of our forests is a great necessity.

Respectfully yours,

DAVID HAUGHS,
Chief Forester.

(REPORT No. 2.)

REPORT OF DR. WALTER MAXWELL UPON THE PIIHONUA LANDS.

The area of land in consideration, held under lease by the Hilo Portuguese Sugar Mill Company, from J. T. Baker, comprises the most makai portion of the Piihonua tract.

The Piihonua tract begins a short distance above the town of Hilo and, widening out on the right towards the lands of Waiau, and on the left towards the district of Kaumana, extends to and embraces all the lands mauka up to the forest line, including some 44,500 acres, as shown by the survey and statement of Surveyor Baldwin.

As said, the area of land in question occupies the lowest portion of the Piihonua tract, and includes some 4,500 acres, and lies below the 2,100 feet level.

The area of lands in question, in the main, lies lower than the lands of the adjacent tracts, and forms generally a depression lying between what may be termed the Waiau ridge, running off to the right, and Kaumana, forming the areas on the left, in the mauka direction. The lands within the said area are in part rolling, and are cut up by gulches.

As explained by Surveyor Baldwin, the said area, extending in a direct line above the town of Hilo, lies between the directions of the two chief rain-bearing winds. The rains brought in from the sea from the

northeast strike against the Waiau elevation, whilst the southeasterly wind first meets the Kaumana elevation. The rainfall of the Piihonua tract is abundant, however, being supplied from the two directions of exposure, and by the influence of the land elevations, as explained, on its right and left sides.

The water heads of the Piihonua tract are abundant and strong, and are relatively independent of adjacent land areas. The water supply is very great, and more than ample for all local farming needs, and for the most extreme requirements of the town of Hilo.

Concerning the utilization of the water supply for extended plantation purposes, such as mill and fluming uses, Mr. H. D. Brown, Commissioner of Water Rights, Hilo, says: "I will say that I do not see how our city water supply can be affected by taking water for the said mill and fluming purposes." Upon the same question, Mr. W. Vannatta, superintendent of Hilo Water Works, says: "The town of Hilo is now supplied from two springs at an elevation of 440 feet, and this supply is sufficient for a much larger town than Hilo. I do not think that water taken for mill and plantation uses will in any way affect our town supply." I have not seen any value in adding to the statements of the water officials at Hilo upon this question.

The removal of forest and clearing of the lands of the said area of the Piihonua tract will not affect the heads and water supply of the adjacent lands. The lands of the so-called Waiau elevation furnish the water heads of the supply required by the Hilo Sugar Company, etc. The waterheads of Kaumana are also independent of the Piihonua tract, and, as shown by the recent examin-

ation of the Olaa Sugar Company, are ample for all future requirements, providing deforestation of the upper Olaa lands does not exceed given limits.

The areas contiguous to, and extending above the township of Hilo, are specially adapted to development, and to settlement by small occupiers and owners. The Government initiated the building of excellent stone roads extending along the Kaumana and Piihonua directions. To the one and three-fourth miles of the Piihonua road built by the Government, the Hilo Portuguese Mill Company has added already two more miles of solid metal highway. As a result of these combined governmental and private works, occupation and settlement have made notable progress. I have ascertained that today the Hilo Portuguese Mill Company is taking cane from 800 acres of land, and furnished by fifteen Portuguese settlers, and forty-five Japanese settlers, or sixty families in all, already located upon those lands. As a further result of the Government road extension, there are now established twenty settlers who are growing cane upon the Kaumana lands of the Lyman estate. In addition to settlement by Portuguese and Japanese families, who are engaged in cane and fruit growing, other types of settlement and occupation are appearing, which is exemplified by the dairy establishment of Mr. Tosch.

The present state and the future development of the industrial interests of Hilo are mainly dependent upon the development of the land areas contiguous to the city. To stop or delay this development of lands for the production of sugar and other crops, will react directly upon the industrial growth of the town of Hilo, and, incidentally, upon the finances of the Territory of Hawaii.

If the Hilo Portuguese Mill Company, or others, should be restrained from the opening up and cultivation of such further lands that may be taken from forest areas without detriment or danger to existing conditions or interests, it is to be expected that that corporation will close down its present business.

Omitting from consideration the immediate results and loss to the said corporation, it is foreseen that loss and actual disaster will fall upon the aforementioned settlers, who are growing cane for that company.

These settlers, as it has been ascertained, have derived not only a general, but also special advantages from the extension of the business of the Hilo Portuguese Mill Company.

(1) That corporation has furnished a more general guarantee for the further existence and maintenance of the settlers as cane-growers.

(2) By entering into competition with other corporations, purchasing cane from small growers, the Hilo Portuguese Mill Company has caused a higher price to be paid for cane to the cane-growing settlers. The price of cane, in consequence of such competition by the mills, has risen from $2.50 to $4.50, and even $5.25 per ton. If one of the competing mills ceases to buy, the settlers must accept a reduced price, even if they all continue to find purchasers for their cane. The present and future state and well being of existing settlers, and the industrial growth of the town of Hilo, are indissolubly bound up with the development of such contiguous lands as are suitable for cane growing, and the maintaining of the milling companies now engaged in the manufacture of sugar.

In view of the several considerations that have been set forth, I have to say that in my judgment,

(1) No detriment whatsoever will accrue, immediately or indirectly, from the removal of forest and application to cane growing of the said small area upon the makai end of the Piihonua tract.

(2) The restraining of further development of cane growing upon the said area will result in the suppression of the present business of the Hilo Portuguese Mill Company.

(3) The closing of the mill of the above milling company must result in disaster to the present cane-growing settlers, and indefinitely restrain the settlement of the lands of the district.

(4) Great detriment must fall upon the industrial interests of the town of Hilo if the land extension and settlement, upon which it depends, are stopped or retarded.

In brief, in view of all these several considerations, I have to advise your Government, and without question or demur, to grant to the Hilo Portuguese Mill Company the right to open up and grow cane upon the above declared area of the Piihonua tract.

(Signed): WALTER MAXWELL.

Honolulu, August 27, 1900.

(REPORT No. 3.)

REPORT OF PROFESSOR ALBERT KOEBELE, ENTOMOLOGIST.

Honolulu, T. H., December 31, 1900.

MR. WRAY TAYLOR,

Commissioner of Agriculture and Forestry.

Sir—Having been absent from the Islands at the close of 1899 I herewith submit to you a report on work for the last two years:

The first six months of 1899 were spent in visiting the various Islands and attending to the general work in the office. About six weeks, from June to August, were spent in searching and importing parasitic insects from California, chiefly for the white cabbage butterfly, PIERIS RAPAE, PLUTELLA CRUCIFERARUM, and the various cutworms. We also brought over a large number of the western salamander, DIEMYCTYLUS TOROSUS, Esch., that were liberated in the upper part of Makiki stream. Of these latter it is expected to be a help in reducing the vast number of mosquitoes breeding everywhere in the small pools and taro fields. Two of these salamanders kept for several weeks in an open tank, did devour and keep the water free of all the mosquito larvae that bred within, while hundreds of the newly hatched larvae could always be observed, yet never any

reaching its full growth. It is to be greatly desired that this valuable betrachian will increase to such numbers as to be able to help us to keep in check the most troublesome insect on these Islands.

In accordance with a letter of introduction from the Commissioner of Agriculture and Forestry, dated June 15, 1899, in company with Mr. George Compere, an agent of the State Board of Horticulture of California, I left for Australia and the Fiji Islands, partly to assist that gentleman, and to collect beneficial insects and plants for these Islands. On this last trip we sent a large amount of parasitic and predaceous insects from the various parts visited, and many of the same became permanently established on these Islands.

At present, we have at least four species of internal CHALCID parasites preying upon the waxy scale, CEROPLASTES RUBENS, Mask, an Asiatic coccid that became so numerous here some five years since, and now it can hardly be noticed at Honolulu. Mr. Compere also sent us from Singapore, specimens of these scales preyed upon by a Lepidopterous larva, THALPOCHARES, Sp.

Unfortunately, all of the material arrived in bad order. We also must acknowledge with thanks, the sending of a few specimens of DACTYLOPIUS VASTATOR, Mask, from Saigon; out of these, a few parasites had hatched on the route.

At the request of the Government of New South Wales, we forwarded two lots of the CEROPLASTES RUBENS, with their internal parasites. All of which have been present longer in Australia than here, but are still a great pest to the various trees and shrubs.

The presence on the Islands of the numerous species of LECANIDAE is hardly noticeable, for all of them are kept in check by the many lady-birds, internal parasites, and two species of fungoid diseases.

On the other hand, I regret to report in some localities, at least, the increase of some of the DIASPIDINAE, yet we have hopes that before long, SPHAEROSTILBE COCCOPHILA will be established here, and the injurious effects of the DIASPIDINAE will be at an end.

From the Fiji Islands we have sent two consignments of the most valuable little lady-bird, ANISORCUS AFFINIS, Crotch, that is found upon all the citrus trees infested with MYTILASPIS CITRICOLA, Pack, in those Islands. In case of failure here we have sent the same insect also to Samoa to be more conveniently at hand in the future, together with a very large Aphid feeding species, ARCHAIONEDA TRICOLOR, Fabr., which as we have repeatedly observed, will entirely clean any large citrus tree of its Aphids within a few days. As previously reported, in 1894, I found this insect feeding upon Dactylopius on the Rewa river, Fiji.

From Australia many shipments of insects were made, and, in general, they arrived in good condition and were liberated. An additional small lady-bird, feeding upon the red spider and several internal Chalcid parasites of the carious Coccids, are of great importance.

A considerable amount of material was also forwarded from Hongkong; an internal parasite of CEROPLASTES RUBENS in its early stages; additional parasites of PULVINARIA PSIDI, Mask, and fungoid disease upon

same; parasites upon DACTYLOPIUS VASTATOR, and a large number of lady-birds deserve to be mentioned.

On April 10th of the present year I arrived in Honolulu. Trips to the various Islands have often been made, and reports upon observations handed to you. Much time has also been devoted to the investigation of the cane-borer, SPHENOPHORUS OBSCURUS, and results reported to Hawaiian Planters' Association.

FRUIT MAGGOT FLIES.

Under this head come a considerable number of very destructive insects likely to appear in the Islands at any time, unless great vigilance is exercised to avoid any possible danger.

So far, our too well known melon fly, DACUS CUCURBIDAE, Coq., is the only species present as far as known; and indeed, it is almost impossible to raise those fruits, or any of the allied forms without proper protection to the plants.

In Mexico a similar fly is destructive to the oranges and sweet lemons. It is known under the name of TRYPETA LUDENS. The larva of a second species, TRYPETA ACIDUSA, is living within peaches. Still another species has been found in that country living upon guavas, which are always found full with maggots. The first named species could be brought here in fruit by way of San Francisco, but none of them have reached this port so far as I know. The possibilities of introducing these maggots in most any fruit is more likely to be from Australia and the South Sea Islands.

The Queensland fruit-maggot-fly, TEPHRITIS TRYONI, Frogg., is long known in that country as one of the

most serious orchard pests. Mr. Henry Tyron, in his admirable report, "Insects and Fungus Pests, 1899," already stated that with the exception of the grape, passion fruit and medlar, all fruits grown at the Toowomba district were affected by the fly. At the same locality during the end of December of last year we found nearly all the plums and prunes on the ground, a living mass of maggots.

According to Mr. Froggatt, "Notes on Fruit Maggot Flies, 1899," HALTERAPHORA CAPITATA, Weidm., the Mediterranean fruit-fly appeared in West Australia during 1897, there attacking most any known fruit, with the exception of the grapes and figs. This same fly is doing much injury to the fruits at Cape Town, where the trees are netted for protection; and it is reported from Bermuda as attacking green, half-ripe peaches and mandarine oranges. Insect Life, Vol. 111, p. 5.

In the same paper Mr. Froggatt describes the guava fruit-fly, TEPHRITIS PSIDI, bred from fruits that came from Noumea, New Caledonia; and another species found to be destructive to bananas in the New Hebrides, as TRYPETA MUSAE. Another, yet undescribed species was in his possession, bred in fruit from the Solomon Islands; all these differ from the two very common forms in the Fiji Islands, which breed most in any wild or cultivated fruit. At those Islands I have been assured that it is never possible to obtain a single ripe orange in good and sound condition, if left upon the tree, as it would become filled with worms. The alligator pears and mangoes are attacked, and we found the guavas, as well as the "Ohia ai," (EUGENIA MALACCENSIS),

always full of maggots, and also a large number of wild fruits.

That noble tree,"BARRINGTONIA EDULIS," has two species of these flies that live upon the edible fruit with its thin pericarp that is all devoured. I have seen the fly in the act of ovipositing its eggs into the green and very hard fruit. It is commendable of the former Board of Agriculture to pass an immediate act, strictly prohibiting the landing of any fruit from the Australian Colonies and the South Sea Islands; the appearance here of one of these flies would mean the destruction of all our fruits.

REMEDIES.

Many so-called remedies have been tried and recommended, yet they are not worthy to repeat. With our melon-fly we can use only preventives, carefully select all the infected fruits and vines and burn or boil the same. This should be done very thoroughly every four or five days, so as not to allow any of the maggots to mature and escape to the ground to pupate. In any locality where the fly has not bred in any number it could be kept down quite easily for any length of time, this all depending upon the willingness and confined actions of the inhabitants. The raising of cucurbitaceous plants under carefully constructed movable frames with wire gauze that would last for years, has been suggested, and these would not entail any great outlay.

PANDAMORUS OLINDA (PERK.).

Since writing on the so-called Olinda bug, in "Notes of Insects Affecting the Koa Trees at Haiku Forest, Maui," specimens were given to me at San Francisco by Mr. Charles Fuchs, who claims that they were formerly common in the gardens of that city. Mr. E. A. Schwartz, to whom we showed specimens, pronounced them as the well known "Fuller's Rose Beetle," ARAMIGUS FULLERI, Horn. The insect is figured in report of the entomologist of the Department of Agriculture, 1879. Dr. Riley states that as early as in 1875, specimens were sent to him by Mr. A. S. Fuller, who found it in greenhouses somewhat injurious to camelias. In his report, Dr. Riley stated that "it seems to be quite widespread, occurring from the Atlantic, at least, as far west as Montana, and its habit of injuriously affecting roses and other greenhouse plants must be looked upon as a comparatively recent acquirement." In regard to the habit of the beetle, he goes on to state that "the female shows a confined habit of secreting her eggs, which are thrust between the loose bark and the stem, especially at the base, just above the ground." It was found that the large number of gall-like swellings on the terminal branches of the koa trees brought down for observation, produced hundreds of young larvae of the rose beetle. Whenever the galls showed any holes, or if partly split, they had been thrust full of eggs, often an inch or more in length. Doubtless this is done by several individuals when present in such enormous numbers as at Haiku.

It should be stated that these insects have only been

observed as injurious to greenhouse plants in the Eastern States, where, as Mr. Schwartz observed, it again disappeared entirely in some localities. This would confirm the belief expressed that the insect likely came here from Mexico. As the best remedy, the destruction of the mature beetle is recommended in America, and with us as already stated, this will prove the easiest way to reduce their numbers.

TINEID LARVA ON COTTON-BALLS.

During the spring of 1899 it was observed that the cotton-balls at the Government Nursery, upon plants planted the year previous, were destroyed to the amount of from 40 to 50 per cent by a Tineid larva that will live upon the seeds in all stages of development, causing the balls to become partly or entirely dry before maturity. The mature insect of this destructive worm is a little moth, a species of GELECHIA, of an almost uniform dusky-brown color, darkest near tips of anterior wings, and it measures from 18-22 m. m. in expanse of wings. Although a large number of the larvae of this insect are destroyed by a parasite, nevertheless, in case of a possible industry of cotton raising on these Islands, this moth may prove a formidable enemy to such undertaking. We have also bred a TORTRICID from these cotton-balls, likely feeding upon the leaves during larva state, and a large number of a very common beetle, ARAEOCERUS FASCICULATUS, De. G., previously bred on coffee cherries from Waianae, also on seeds of koa, the mamani, and many others; even a seed pod of the kola nut pro-

duced quantities of this beetle that will breed equally as well in dead wood.

ADORETUS UMBROSUS (JAPANESE BEETLE).

During the past summer we have had letters showing that the Japanese beetle has now spread to all parts of the Islands. Owing to the dry season it became quite numerous in some localities during August and September, chiefly so, where it appeared for the first time. Large numbers of diseased beetles were sent out to spread the contagion with more or less good results. We shall be in position the coming season to raise this fungoid disease artificially and distribute in proper time to avoid any serious invasion of the same, in such localities, at least, where we have the required amount of rainfall.

Brother Newell of Hilo has kept up his good work in that district of raising and distributing diseased beetles, of which, between three and four hundred thousand specimens have been sent out up to September of the present year.

That valued flower, the rose, is seen more commonly in Honolulu, and it may again become as numerous as before. The beetle is not numerous during the months from November until May, and even June, but during the intervening months, if found necessary, the plants could be trimmed and strongly protected by netting. We have seen plants only surrounded with netting, some eighteen inches higher than plant and open above, hardly affected by the beetle.

SILK CULTURE AS AN INDUSTRY IN THE HAWAIIAN ISLANDS.

The raising of silk worms had long since been attempted in the Hawaiian Islands, and the black-mulberry tree, MORUS NIGRA, originally introduced and cultivated for this purpose, has become naturalized in various parts of the Islands.

Some time since an attempt was made to revive this industry by importing large numbers of cuttings of the better varieties of mulberry trees. Various parties undertook to raise the worms in hopes of a possible paying industry. At the Government Nursery a few hundred of them were raised by experienced Japanese, who had done such work since childhood, and these proved to be the best cocoons that came under my observation on these Islands. These worms were fed upon leaves of a variety of mulberry growing at the nursery of which name I am not certain, likely MORUS ALBA., yet the leaves of those gave out and those of M. NIGRA had to be substituted during the last two stages of their growth, doubtless interfering somewhat with their silk producing quality. It is known that this variety of tree is inferior as food of the worms to M. ALBA., or the white mulberry; nevertheless, we estimated that from 950 to 1,000 choked cocoons would be required to make one pound less than a fair average.

The question has often been asked, how many broods can be raised annually? As yet we have had no experience. The eggs obtained here and simply kept in rooms, would hatch at any time between two weeks and six months or more. It would be different with eggs

kept in proper condition, in a cool chamber, at a temperature somewhat above the freezing point. As required these could be brought out and would readily hatch at any time in our climate of about 75 degrees Fahrenheit, and silk worms could be raised almost during the whole year.

A Swiss merchant with whom I recently traveled in the East, informed me, that in Italy, under agreement, but one annual brood of worms is raised, since the cocoons of the second brood are much inferior in quality. In Japan, according to the variety of broods, these vary from one to three. At Canton, China, as this gentleman informed me, seven broods of silk worms are raised annually.

As to the remunerative question of this industry, I give some notes from Bulletin No. 9:

"The mulberry silk worm, United States Department of Agriculture, Washington, 1886.

Profits of producing cocoons: Estimates for two adults, or man and wife.

Average number of eggs per standard ounce of 25 grams, in ordinary yellow races, 37,500.

Number of fresh cocoons per pound, 300 to 400. Average reduction in weight for choked cocoons, 66 per cent.

Maximum amount of fresh cocoons from 1 ounce of eggs, 93 to 125 pounds.

Allowing for deaths in rearing—26 per cent being a large estimate. We thus get as the product of an ounce of eggs, 69 to 92 pounds, if fresh, or 23 to 31 pounds of choked cocoons.

Two adults can take charge of the issue of from 1 to 3, say 2, ounces of eggs, which will produce 138 to 184 pounds of fresh, or 46 to 62 pounds of choked cocoons.

Price per pound of fresh cocoons (1885), 35 cents (300 cocoons per pound).

One hundred and eighty-four pounds of fresh cocoons, at 35 cents, $64.80.

Price per pound of fresh cocoons (1885), 25 cents (400 cocoons per pound).

One hundred and thirty-eight pounds of fresh cocoons, at 25 cents, $34.50.

Price per pound of choked cocoons (1885), 80 cents to $1.15.

Value of above products, choked, $36.80 to $71.30."

As it can be seen from the above, favorable conditions included, it will take two persons about forty days to produce fifty pounds of choked cocoons that will sell, either in Southern France or Italy, at an average of one dollar per pound. As I have been informed by that Swiss silk merchant, the price of choked cocoons, at the beginning of the present year varied from 4 to 6 francs, 80 cents to $1.20 per pound in France and Italy.

As to the quality of the cocoons likely to be produced here, the letter of Dr. Howard, to whom we sent samples, will explain. "I have examined the silk worm cocoons with interest. Those from Hilo are very poor. They are thin and flimsy. The ones from the Government Nursery at Honolulu are better. Some of the pods are quite firm, but I should not call them first-class cocoons by any means. There is no market for cocoons in this country. As you know, we have practically given up the idea of starting silk culture in the United States."

Our experience has shown the facts given in the enclosed letter, which I am sending out now to applicants for silk culture information.

The practical investigation of silk culture by the Department of Agriculture, on which we base our recommendations, began, as a result of an agitation of the subject dating from the Centennial Exposition of 1876, and was carried on by virtue of specific appropriations by Congress, continuing, practically, from 1884 to June 30, 1891. The experiments were conducted on an extensive scale, the work being placed under the supervision of the Division of Entomology.

The experience prior to 1886 had established the possibility of raising a most excellent quality of silk worm cocoons over nearly the whole country, but it had also fully demonstrated that the superior price of labor in the United States put any possibility of profit in the industry out of the question. This was largely due to the fact that it was found impossible to convert the cocoons into raw silk, namely, to reel them, in this country in competition with the cheap labor in foreign silk raising countries. Hence, in America, there could be no market for cocoons, and to sell them in France or other European countries meant a smaller compensation even than that received by the peasant silk raiser of Europe, on account of the long distance of freightage.

The work of the Department was, therefore, especially directed to efforts to remedy this state of offairs, and to equalize by improved machinery the difference in wages between our own and foreign countries, thus making it possible for the manufacturer to pay a better price for cocoons. Electric silk reels were set up and remained

in operation for several years. Improvements in these reels were constantly being made in the direction of economy and efficiency, but it was definitely shown by 1890 that no silk reeler could afford to pay a price for cocoons which would induce even the poorest of our citizens (or even the non-producing members of his family), to undertake the more or less arduous labor of raising worms. The sole remedy at that time seemed to be the levying of an import duty of not less than $1 per pound on reeled silk imported into the United States. An effort was made by friends of silk culture to secure such a duty at the time when the McKinley tariff bill was under discussion in Congress. The effort, however, failed.

In view of the above, there can be no question but that serious disappointment will surely follow exaggerated ideas upon the subject of silk raising for profit in the United States, and if you are contemplating such a course you are very strongly dissuaded therefrom.

Respectfully submitted,

ALBERT KOEBELE,
Entomologist.

(REPORT No. 4.)

REPORT OF PROF. KOEBELE ON DESTRUCTION OF FOREST TREES, HAWAII.

Honolulu, T. H., Sept. 12, 1900.

WRAY TAYLOR, ESQ.,

Commissioner of Agriculture and Forestry.

Sir: As requested by you, I have made a trip to Mr. E. P. Low's ranch at Puuwaawaa, Hawaii, to look into and report on the depredation of insects on the forest trees.

Within the last year or so, ICERYA PURCHASI, Markell, has been very destructive to some of the trees, and chiefly to the "Mamani," SOPHORA CHRYSOPHYLLA, but at the present time this destructive scale insect has practically disappeared. Its formidable enemy, the VEDALIA CARDINALIS, was found in full force. Owing to the isolated appearance of ICERYA, often miles apart, it is that this pest has at times become numerous, as has been the case in times gone by at Kona, Kohala and at Hamakua.

At the present time the insect was noticed all along the road from Kailua to Puuwaawaa, yet only in single, individual or small colonies, showing that the VEDALIA is present throughout this district. The more the ICERYA becomes disseminated, the less is the danger

of its becoming a pest, as its enemy will follow wherever it appears.

Of other insects, two species of LECANIUM were found present in numbers; L. NIGRUM is the most numerous, attacking a great variety of trees and shrubs, yet it is badly parasiticed by CHALCID flies. Specimens were found upon a mulberry tree, nearly every single individual destroyed by the CHALCID flies.

In addition to the parasites, two species of fungoid diseases are present, as all over the Islands, having been introduced some six years since. It is owing to the want of sufficient moisture that these do not develop sufficiently in the Puuwaawaa District. A few days of rain and cloudy weather will immediately spread the deathly disease among them.

L. LONGULUM was found also well represented, and as the foregoing, it has sufficient enemies to keep it in check.

PULVINARIA PSIDI, at one time threatening the coffee industry of the Islands, is present here and there, yet always accompanied by its enemy the CRYPTOLAEMUS MONTROUZIERI, which will make it impossible for the PULVINARIA to ever again become a destructive pest. When in China, last spring, we collected and successfully introduced to the Islands additional enemies for this scale; one of these a CHALCID fly destroying the insect in its earliest stages, is of great value.

One or two species of ASPIDIOTUS are spread throughout the district upon wild and cultivated trees preyed upon by internal parasites. Nowhere has this been seen to do any noticeable injury to plant life, except upon a couple of cultivated trees, which, with a lit-

tle attention given to the same, can easily be avoided. Moreover, we shall forward additional parasites and predatious insects to this locality.

DACTYLOPIUS CERIFERUS, the common tropical mealy bug, formerly so numerous in Honolulu, was found to infest some of the "wiliwili."

ERYTHRINA MONOSPERMA; here also the CRYPTOLAEMUS beetle was found to be present and devouring the same.

All of the above insects are of foreign origin, and without the assistance of the introduced predatious and parasitic insects, they would be detrimental to plant life.

It is different with the various indigenous forms of insects preying upon foreign trees. All these have their parasites, and are in consequence hardly detrimental to the particular trees they prey upon, since most of them have existed for thousands of years.

According to the observations of Mr. Perkins, it is the larva of SCOTORYTHRA IDOLIAS, a span worm, found on all the Islands, that almost annually denudes the koa trees of their leaves; doubtless these conditions have not always existed. In former times, the koa trees have had a dense underbrush consisting of various young trees, and especially ferns, keeping the ground and the base of the trees continually moist; the SCOTORYTHRA larva in pupating come down to the ground; then it is that most of them are destroyed by a fungoid disease indigenous to these Islands, and requiring moisture for its development, the same disease so successfully made use of against the depredations of the Japanese beetle.

Since the total destruction of undergrowth in the koa forests, and the even drying up of the ground, this disease is becoming less effectual and naturally the insect more numerous. It is but a few weeks that the worms are numerous enough to defoliate the trees; very soon the new leaves reappear again and no trace of the worms is noticed, this only appearing periodically.

As to the natural enemies of this geometrid larva, very little is known; we have had no opportunity of breeding the same. Of the very numerous specimens of various indigenous species, some doubtless will prey upon them.

The Asiatic CHALCIS OBSCURATA, Walk, doing such splendid work on this Island, where it has just been introduced, has been met with, as yet not in large numbers. On Kauai, where this insect has been introduced some five years since, it has become very common.

The seeds of the koa trees were destroyed to some extent by the larva of a TORTRICID, apparently a species of CARPOCAPSA, and, as Mr. Perkins informs me, it is represented on all the Islands. We are breeding the same at present from a lot of seeds of "Mamani," SAPHORA CHRYSOPHYLLA, brought down from Puuwaawaa. Judging from the large quantities of parasites issuing, these larvae are never so numerous as to destroy all the koa seeds. Perhaps more numerous is a weevil, of foreign origin, represented on all the Islands wherever the koa tree is growing, upon the seeds of which it breeds. Not only is this the only tree upon which it is found, but the seeds of most of the ACACIA, and especially those of PROSOPIS DULCIS, are destroyed by this BRUCHUS. Nevertheless, any part of a koa forest fenced off, or entirely undisturbed, will soon re

produce large quantities of young trees of this valuable timber, as can be seen at Lihue, Kauai.

What is most apparent throughout the dying forests are the numerous small holes seen on some of the trees, in an unhealthy condition. It is supposed that the insects producing the same are the cause of the ultimate decay of the trees, which is by no means the case. In any undisturbed forest such signs are indeed a rarity, save perhaps on the "Naeo," MYOPORUM SANDWICENSE, which practically has these holes during the entire time of its existence, with but little detriment to the plant itself. If by any cause, natural or otherwise, a tree becomes injured, a branch blown off, etc., the first insects to appear are the indigenous CERAMBYCIDAE, which produce the holes referred to. As a fact, it is the greatest help to a collector of these insects to cut down one of the particular trees, upon which the desired beetle feeds; in a couple of days or so, they will often appear in large numbers ready to oviposit their eggs.

I will now refer to the more common and well-known form of these CERAMBYCIDS, and the respective trees upon which they breed. It must be borne in mind, however, that the insects referred to will never attack trees in a perfectly healthy condition. A peculiarity of these insects is their habit; instead of being nocturnal, they are active during the hottest part of the day, from 10 a. m. to 3 p. m., when the sun is highest.

PLAGITHMYSUS VARIANS is found upon the koa tree on Hawaii, where it breeds both in the trunks and larger limbs, as do the rest of the genus.

PLAGITHMYSUS PULVERULENTUS, and

PLAGITHMYSUS CRISTATUS, are found upon the same tree on Oahu; on Kauai two other species are found upon the same tree; these are PLAGITHMYSUS AEQUALIS and PLAGITHMYSUS ARACHNIPES.

Four species are known to breed upon the "Mamani," SOPHORA CHRYSOPHYLLA. Of these two are found on Hawaii, PLAGITHMYSUS DARWINIANUS and PLAGITHMYSUS BLACKBURNI. The first was found very common at Puuwaawaa, where the tree is numerous as yet.

PLAGITHMYSUS FUNEBRIS is found on Maui, and PLAGITHMYSUS BILINEATUS on this tree on Kauai.

The large genus of "Alani," Pelea, have so far four known species, two out of these are known to occur on Hawaii. PLAGITHMYSUS BISHOPI and PLAGITHMYSUS VICINUS have been found on these trees by Mr. Perkins, and the first-named has been met with at Puuwaawaa.

PLAGITHMYSUS COLLARIS occurs on Maui, and PLAGITHMYSUS DIANA on Kauai.

The "Ohia Lehua," METROSIDEROS POLYMORPHA, has four known species at least, PLAGITHMYSUS FINSCHI and PLAGITHMYSUS PULVILLATUS are on Maui; PLAGITHMYSUS LANAIENSIS on Lanai; PLAGITHMYSUS AESTIVUS on Molokai. We know that this tree is also attacked on Hawaii.

The "Ohia-ha," EUGENIA SANDWICENSIS, is affected on Kauai by PLAGITHMYSUS CONCOLOR, and on the same Island PLAGITHMYSUS PERMUNDUS infests the "Ahakea," BOBEA Sp. The same trees are

attacked on Oahu by CALLITHMYSUS MICROGASTER.

PLAGITHMYSUS PERKINSI is the insect upon the "Naeo," MYOPORUM SANDWICENSE, on Hawaii. PLAGITHMYSUS LAMARKIANUS is found upon the "Mamake," PIPTURUS ALBIDUS, on the Island of Hawaii, whilst on Oahu, upon the same tree, an undescribed species was found.

At Puuwaawaa we found two new species of PLAGITHMYSUS, one inhabiting the "Aiea," NOTHOCESTRUM BREVIFLORUM, and the other is found breeding in the "Koko," or "Akoko," EUPHORBIA LORIFOLIA, a dead tree of which was found filled with larvae, which are rather badly parasiticed.

Another genus, of rather small CERAMBICIDAE, is living chiefly in the dead branches of various trees, and as far as known they are attached to SOPHORA CHRYSOPHYLLA and ACACIA KOA. CLYTARLUS FILIPES and CLYTARLUS MEDIOCRIS have been found on the first-named tree, on Hawaii and Maui respectively.

Ten species are known to infest the koa tree, CLYTARLUS DEBILIS, CLYTARLUS CLAVIGER, and CLYTARLUS NODIFER, on Hawaii; CLYTARLUS MODESTUS, CLYTARLUS LATICOLLIS, and CLYTARLUS PENNATUS on Maui; Oahu has but one known species, CLYTARLUS FRAGILIS, which we breed from dead branches of koa from Nuuanu valley. The branches were brought in during December, 1898, and on January 16, 1899, seven beetles had issued, and of parasites, 46 females and 25 males. Again on March 3d, 1899, we counted 14 beetles, 110 females and 55 male parasites; all these of one species and found on all the

Islands, parasitic upon PLAGITHMYSUS as well; it has also been bred upon larvae of introduced CERAMBYCIDS.

The three other species, CLYTARLUS MODESTUS, CLYTARLUS LONGIPES, and CLYTARTUS ANNECTENS, were found by Mr. Perkins to breed upon the koa tree on Kauai.

We have bred a species of CLYTARLUS from trunk of "Papala," CHARPENTERIA OBOVATA, on place where bark had been badly eaten by cattle at Puuwaawaa.

The above are about the first indigenous insects to appear on diseased timber trees. After these come a large number of various genera and species preying upon dead wood. As a fact, the most of the Hawaiian Coleoptera, are known to live upon trees in such condition. In addition, larvae of Tineidae make their appearance, readily noticed by the webs intermixed with remains and excrement of the same. Usually this remains as long as the trees are in an upright condition, or until the last stage of their existence.

Now we come to the greatest enemies of the beautiful Hawaiian forests, the worst and most destructive ever introduced among tropical forests, which will sooner or later, but positively and entirely disappear before the army of devastating cattle. I doubt that anything in nature, axe and fire included, would have in the same space of time brought the once densely clothed Islands to the present condition.

If we could look backward fifty or sixty years, we would see the two large mountains of Maui meet by trees on the plains; Lanai and Molokai clothed with for-

ests; Oahu the same, native trees in numbers down to Honolulu; four miles or more of a dense and impassable virgin forest in Nuuanu valley; the Waianae mountains with a mantle of beautiful green vegetation; Kauai, the fairest of all, the Lihue plains an undisturbed forest, as all along the west on the windward side, and the forest on the leeward side coming down to the sea, in parts at least. We would see in places uniformly running streams, and ever-flowing springs. Doubtless such has been the condition of the Islands. The changes have been brought on to the benefit of the very few, to the detriment of the whole Islands and community. Today, especially on the leeward side of the Islands, the cancer spots are visible everywhere and growing continuously; the grass has disappeared, each successive rain takes away more of the soil, and during the sunny days the wind is taking the same far out to sea. With these conditions, these barren spots will grow into barren rocks, where not even the denounced lantana (the salvation plant of the Islands) will grow. I fear to express an opinion of the state of conditions fifty years hence; yet we must trust in a body of men to form laws and regulations filling the demands of the Islands. What is mostly and immediately wanted are strict laws to compel every cattle owner to fence in his or her cattle, and liberty to any one to take or shoot any animal found outside such enclosures, even paying a bonus for any such beast so destroyed.

On the lower end of Puuwaawaa Ranch, we find a mixed forest of a large number of trees, among them some of the most valuable timber, such as the SANDAL WOOD, SANTALUM FREYCINETIANUM, the "Kauwila," ALPHITONIA PONDEROSA, and many others

growing among the lava rocks. Some four or five species of trees are destroyed by the cattle that eat off the bark, like the "Wiliwili," the "Papalo," and other soft-wooded species.

The principal food of cattle in this district is the underbrush, breaking the rays of the hot sun on the lava rocks; the animals will browse upon the young trees, and eventually destroy the same, leaving the older plants with the surface wood exposed. It is only a question of a few years until all the trees on such places disappear entirely. Example, the piece of land between Mr. John McGuire's house, and the lava flow north, with former forest dead and dried up timber on the ground. It took the cattle a very few years to accomplish this.

The upper part of the ranch comprises some 12,000 acres of fertile Government land, covered with valuable forest trees, among them the famous koa. It is here where we have seen the sandalwood tree over eighteen inches in diameter. Five years since the present leaseholder had to hew a trail to see the condition of the land; today we find a handsome open park land, so to speak, where one can ride anywhere on horseback. I venture to say that at the expiration of the lease, twenty years hence, we will find an open pasture land, very much in want of moisture.

For the benefit of the country and community at large, the Government could well afford to pay the lessee one thousand for every dollar it receives as rental for the rest of the term. Leaving the necessity of a forest out of the question, the protection of these valuable timber trees alone would sufficiently pay for all outlays.

With the kind help, and the furnishing of the native names by Mr. Low, we collected and brought down seeds of the following species of trees, now planted at the Government Nursery, and at Moanalua:

"Wauke," BROUSSONETIA PAPYRIFERA.

"Kauwila," ALPHITONIA PONDEROSA.

"Alani," PELEA Sp.

"Aiea," NOTHOCESTRUM BREVIFLORUM.

"Kea" or "Kalamona," MEZONEURON KAUAIENSE.

"Halapepe," DRACAENA AUREA.

"Olapa," CHEIRODENDRON GAUDICHAUDII.

"Hoolei," OCHROSIA SANDWICENSIS.

"Iliahi," SANTALUM FREYCINETIANUM.

"Naio," MYOPORUM SANDWICENSE.

"Aulu" or "Kaulu," SIDEROXYLON SANDWICENSE.

"Mamani," SOPHORA CHYSOPYLLA.

"Pua," OLEA SANDWICENSIS.

"Papala," CHARPENTERIA OBOVATA.

"Pilo," KADUA GRANDIS.

"Aalii," DODONAEA VISCOSA.

"Awikiwiki," CANAVALIA GALEATA.

"Wiliwili," ERYTHRINA MONOSPERMA.

"Kookoolau," An ornamental, yellow-flowering, composite shrub; seeds of one of the numerous LOBELIACAEA.

"Alahee," Cannot be found in Hillebrand.

"Aa," A large tree only known to Mr. Low in a couple of specimens.

Respectfully submitted,

ALBERT KOEBELE,
Entomologist.

(REPORT No. 5.)

NOTES ON INSECTS AFFECTING THE KOA TREES AT HAIKU FOREST ON MAUI, BY PROF. ALBERT KOEBELE.

WRAY TAYLOR, ESQ.,

Commissioner of Agriculture and Forestry.

Sir: As requested, we visited the forests of Maui to the windward and between Makawao and Olinda. More properly, the investigation in regard to the reported destructive insects were made in the neighborhood of Hocking's old sawmill, where for the last few years a successful attempt has been made to reforest the district, at one time a dense and impassable jungle. At the present time, where the forest had been cut, we find remains of old koa stumps in a decaying condition still standing and upon the ground. Larvae and mature insects of PARANDRA PUNCTICEPS, a Cerambycid, is present in large numbers, as also AEGOSOMA REFLEXUM, formerly on sugar cane at Spreckelsville.

There are very few indigenous trees. Everything covered by the Hilo grass seriously interferes with the growth of young trees; in fact, the space around the roots has to be kept free of grass to allow the young plants to grow. Practically all the trees planted by the Hon. H. P. Baldwin are of foreign origin, succeed well and are hardly affected by insects, save the so-called "Olinda

bug" devouring the leaves. This gentleman informs me that the planting will be kept up to the extent of some 60,000 trees per annum until the whole district is again covered by a forest so ruthlessly destroyed for the benefit of a single individual. Mr. Baldwin had large tracts of grass land plowed, and the young koa trees sprung up from the ground by the hundreds, and from all appearance, in years to come, these valuable trees will again become more numerous.

Mr. Baldwin informs me that some four years since, all the old koa trees in the whole district died. Today, even the dead tree tops can be seen everywhere. It would be a most difficult matter to say with any certainty, at this date, what agency has brought on this wholesale destruction. As I am informed, the animals had been taken out of the forest some two years previous—nevertheless the after-affect may be noticed for many years to come. We know that by clearing out the underbrush by cattle, exposing and injuring the surface roots of these trees will bring them in a condition not to be able to withstand one of those periodical defoliation by the Span-worms (Geometrical larvae). We are not positive whether the Hilo grass has run all through the forest or not, but in places visited the same is covering everything, changing the whole condition of things, and still we find any amount of the healthiest koa trees of all sizes, at the present time, even in the open, wind-swept land, where no animals are found.

The following insects are found more or less injurious to the koa trees:

PANDAMORUS OLINDAE, Perk.

The so-called "Olinda bug," also found on Oahu, and lately in destructive numbers at Kohala and Kau, on Hawaii. The injury of this beetle to trees is in reality not as serious as it would appear, and its presence upon older trees is barely noticed, while upon the young trees growing amongst the Hilo grass, its presence is more apparent. We have seen many trees of the Java plum, recently planted, with every leaf eaten off, and some have died from the effects of the beetle and Hilo grass combined, while others again barely showed any sign of the beetle. Reports from Kohala state that the beetle also devours the bark of young trees; this we have never observed, but yet have no doubt of its accuracy where food is scarce. Most any plant or tree is attacked by the beetle and even the grass. The insect appears to be most numerous along the border of the forest, and it is found from the sea shore up as high as 5,000 feet. Seven years since we have been shown the beetle at Paia, destructive to roses and garden plants in general. Mr. Perkins reports of having seen remains of the same at the base of koa trees near Olinda, some years since, to a depth of several inches. It must have been present on the Islands long before it became prominent, and it is likely an introduction from Mexico, and probably come from Acapulco.

The life history of the beetle is as yet, but imperfectly known. We have found its larvae under stones at Olinda, four years since, and collected large numbers of the same in all stages, on this trip, feeding on the roots of Hilo grass. We have obtained its eggs in confinement, deposited in clusters of some seventy-five, of a light yellow

color from three-fourths to one M.M. long and half as wide. At the office we find that large numbers of young larvae issue from galls produced by the Tortricid larvae. Here the eggs are inserted anywhere conveniently where a hole is present, and are imbedded in irregular masses, partly covered by excremental remains. We should think that they are also found under the bark of trees where the beetles feed on. In gardens and small areas of land the beetles are easily dealt with since they are wingless and can only crawl. They can readily be shaken off smaller trees and destroyed in a bucket of water with a little kerosene; this can be done at any time during the day or night, while the beetles remain stationary upon the plants, and, if numerous, will congregate in clusters.

Of enemies the Pandamorus Olinda has not many. The indigenous Carabid beetles on higher elevations must destroy many of their larvae.

Insectiferous birds evidently feed largely upon the beetles. We found excrements of the mynah bird consisting entirely of remains of these beetles. Quails are considered as excellent birds to destroy such insects, fowls, should keep the surroundings of houses free of them. Probably some 90 per cent of the food of the mongoose consists of insects, roaches, crickets, grasshoppers and centipedes, and, from examination made, he also feeds upon the "Olinda bug."

THE LARVAE OF A TORTRICID.

A young koa tree in tender, terminal twigs, long, gall-like swellings are noticed of various lengths, the small moth laying its single eggs, no doubt, in the axis of

leaves and the young worm on hatching enters the tender wood at this place, where it remains until full grown, forming this elongated, gall-like swellings. On maturing, the larvae leave these galls, probably to pupate under the bark of the trees. We are breeding the same, and shall give a full account at some future time. As I have been informed by the forester, Mr. Lindsay, it is only at certain times in the year when these worms are found. Not only are those larvae found living within young and healthy wood, but we found them inhabiting other swellings of branches produced by a more serious enemy to the koa tree, a fungoid disease; in fact, these very larvae were repeatedly seen to devour the tender galls and spores of this fungoid, both on twigs and upon the leaves, and thereby are in reality beneficial in this case. These gall-like swellings are found most numerous upon branches affected by the disease, producing a tender, spongy growth.

Since writing the above we have bred one of these moths and it proves to be the same as that destroying the seeds of the koa and mamani trees. It had pupated within the gall and the empty pupa case, as on the koa beans, and is partly protruding.

GEOMETRICAL LARVAE.

Several species of span-worms are found to live upon the koa leaves on all the Islands, and at times become so numerous as to defoliate the entire trees. We found them common everywhere, yet not in any serious quantity. Pupae of same were found under bark and in the ground. The Asiatic parasite, CHALCIS OBSCURATA,

is amongst them, preying upon the chrysalids wherever this can be reached.

FUNGOID DISEASE.

Generally towards the windward side, the trunks and branches of young koa trees appear to be covered with peculiar gray elevated spots, small on the trunk and larger in size towards the terminal twigs, which in addition show roundish swellings of various sizes. At joints of branches and axis of leaves, before an advanced stage, when the leaves are still present, the latter show irregular swellings covered with brown dust—the spores of the disease. Often the entire leaf may be affected and is then curled up in all sorts of fantastic shapes, becomes black and dies off. The elevated spots on branches burst open to release the fruit of the disease. The round swellings may often grow in a spongy mass one inch or more in diameter. The wood on terminal twigs is all affected and spongy, and a favorite place for the Tortricid moth to lay its eggs. The galls produced by the larvae begin to swell on the inner walls and split throughout the whole length. Small trees are affected in open grass land generally succumb. These conditions have not been noticed, or only slightly, upon young trees growing under original conditions, amongst ferns and protected by large trees. Doubtless this disease is found upon the koa trees on all the Islands, yet it is hardly noticed upon healthy plants growing amongst proper natural environments.

Respectfully submitted,

ALBERT KOEBELE,
Entomologist.

III. 34

TERRITORY OF HAWAII—

REPORT

OF THE

Commissioner of Agriculture

AND FORESTRY

FOR THE

BIENNIAL PERIOD ENDING DECEMBER 31ST,

1902.

:o:

HONOLULU:
GAZETTE PRINT
1903.

REPORT

OF THE

Commissioner of Agriculture and Forestry.

HONOLULU, TERRITORY OF HAWAII, June 30, 1902.

HIS EXCELLENCY SANFORD B. DOLE,

Governor, Territory of Hawaii.

Sir:—I have the honor to submit the following report of the Commissioner of Agriculture and Forestry for the year ending June 30th, 1902. This report touches on the work of the Government Entomologist; Lantana scale; Nuuanu Forest station; Tantalus forest; the Government Nursery; diversified industries; new varieties of trees planted, with their comparative vigor and growth; the visit of Mr. E. M. Griffiths, U. S. Expert Forester; the work of the U. S. Agricultural Experiment station; distribution of seeds and plants, and the forest fires in the districts of Hamakua and North Hilo, Island of Hawaii.

The past year has been a very active one and I do not hesitate in saying that the work done has far exceeded

that of any previous one in the history of this department, which was established as a Bureau by an Act of the Legislature of the Hawaiian Kingdom, on the 4th day of January, 1893. And it may be further said that the work accomplished must be beneficial to the agricultural interests of the Territory, if not right away, certainly at no distant date. The office is to a large extent a bureau of information. From all over the Territory and foreign countries have come letters by every mail seeking information on agricultural matters. These have been carefully answered and there has been no attempt whatever at exaggeration, plain facts only have been given. Many tourists have visited the office as I keep there a display of Island woods, forest photographs, blights, beneficial insects, seeds of many different kinds, also fruits in preservative. The office is small and does not admit of a large display which could easily be obtained, and made very attractive. Owing to the prevalence of certain blights and the absence of the entomologist, it has devolved on your Commissioner to make personal visits to note the affected trees and suggest the remedies, whenever complaints have been made.

This has left no one in the office able to answer questions and give advice in agricultural matters. Part of the duties of your Commissioner is to visit (or send a representative at least once a year) the homesteads and principal agricultural enterprises throughout the Territory, but as the Legislature made no appropriation for travelling expenses, I have on several occasions sent out the Forester, who was supplied with an appropriation for expenses. This will no doubt be remedied by the next Legislature.

THE GOVERNMENT NURSERY.

The free distribution of palms, shade, windbreak and ornamental trees, shrubs, vines, and fruit trees has been exceedingly large during the year, no doubt, caused by the many new homes built in the suburbs of Honolulu. This increased demand led me to suspend distribution during the first three months of the year so as to get well ahead with the planting of seeds, increase the number of germating beds and make other needed alterations. C. J. Austin was appointed Gardener September 1st, 1901, and his work has been very systematic. The total number of plants distributed during the year was 32,341, divided as follows

Palms	8,082
Shade and windbreak trees, shrubs, etc.	11,861
Fruit trees	4,571
Forest trees	7,827
	32,341

The distribution by islands was as follows:

Oahu	25,250
Hawaii	2,631
Maui	506
Kauai	3,267
Molokai	687
	32,341

Two days each week were set apart for the distribution, but in order to give every convenience to the public these were increased on May 1st, 1902, to every day in the week except Saturdays. The upper part of the grounds is used for experimental purposes.

There has been grown here alfalfa, red clover, teosinte, sorghum, Buffalo grass, Kentucky blue grass, corn, crimson clover and pencillaria, records of which are kept and by these is determined what seeds are best for distribution. In another part of the grounds we are experimenting with Samoan taro, yams, dryland and wetland taro.

The Nursery has been visited during the year by a very large number of people, including many scientists and tourists. Many rare trees are to be found in the grounds. At one time, we had about seventy large ornamental palms in tubs, which were loaned out for the benefit of the public for decorative purposes, but they came back in such bad condition on several occasions, that I discontinued the practice and divided them among the public schools, where they are much appreciated, and well taken care of. Also sent some to the hospital for incurables.

There is kept on hand at the Nursery a large quantity of resin and other washes to be used for the spraying of affected plants. These washes are distributed in quantity to those applying for them. The old quarters occupied by the laborers have been taken down and new ones erected. Repairs have also been made to the gardener's cottage. One man is kept busy doing nothing else but going out and collecting seeds.

There is now at the Nursery for free distribution the following varieties and number of trees and plants:

Adenanthera Pavonia—Red sandal wood.....	2,000
Acacia Baileyana—Cootamundra Wattle.....	28
Acacia Melanoxylon—Australian blackwood.....	180
Acacia Pendula—Weeping myall.....	37
Albizzia Lebbek—Siris tree	400
Anona Muricata—Sour sop	360

Averrhoa Carambola—Chinese Fruit	80
Achras Sapota—Sapota plum	86
Bauhinia Tomentosa—St. Thomas tree	200
Bignonia Tweediana—Vine, orange flowers	100
Citrus Lemetta—Lime tree	1,250
Caesalpinia Pulcherrima—Pride of the Barbadoes	250
Cassia Fistula—Golden shower	1,650
Cassia Nodosa—Pink and white flowers	920
Cassia Grandis—Pink flowers	900
Casuarina Equistifolia—Ironwood	2,000
Clitoria Ternatea—Blue Pea Vine	300
Chrysophyllum Cainito—Star apple	18
Calophyllum Inophyllum—Kamani	208
Carica Papaya—Papaya	600
Eucalyptus Citriodora—Lemon gun	400
Eucalyptus Globulus—Blue gum	150
Eucalyptus Robusta—Swamp Mahogany	500
Eugenia Jambos—Rose apple	133
Eugenia Jambolana—Plum	250
Eugenia Michelii—Surinam Cherry	30
Erythrina Monosperma—Wiliwili	300
Eriobotria Japonica—Loquat plum	60
Grevillea Robusta—Silk oak	350
Hibiscus Populneus—Milo	260
Ipomea Chrysantha—Vine yellow flowers	96
Jasmime Vine	38
Lemon—Rough skiu	2,000
Macadamia Ternifolia—Australian nut	145
Mamgifera Indica—Mango	504
Murraya Exotica—Mock orange	40
Musa Ensete—Abyssinia banana	26
Persea Gratissima—Alligator pear	62
Pandanus Hala—Screw palm	110
Parkia Africana—African locust tree	690
Pinus Maritimus—Cluster pine	30

Pinus Ponderosa—Yellow pine	35
Pinus Pinea—Parasol pine	35
Pinus Torreyana—Small coastal pine	35
Poinciana Regia—Scarlet flowers	1,250
Poinciana—Yellow Flowers	2,000
Poinsettia—Shrub scarlet leaves	300
Passion Vine—Yellow fruit	100
Spondias Dulcis—Vi apple	50
Schinus Molle—Pepper tree	1,000
Thevetia Nereifolia—Yellow oleander	70
Tecoma Stans—Yellow elder	35
Ylang Ylang	230

PALMS.

Arenga Saccharifera—Sugar palm	510
Areca Rubra—Red palm	3,500
Areca Catechu—Betel nut palm	80
Chamaerops Excelsa—Fan palm	20
Caryota Urens—Wine palm	1,700
Elaeis Guineensis—Oil palm	50
Hyophorbe Amaricaulis—Bottle palm	170
Kentia Macaurthurii—South Sea palm	15
Latania Borbonica—Fan palm	2,800
Latania Glaucophylla—Blue palm	265
Livistona Rotundifolia—Ornamental palm	1,065
Oreodoxa Regia—Royal palm	1,100
Phoenix Dactylifera—Date palm	250
Pritchardia Gaudichaudii—Hawaiian loulu palm	2,300
Sabal Blackburniana—Fan palm	250
Seaforthia Elegans—Australian palm	880
Thrinax Argentea—House palm	1,400

MAKIKI OR TANTALUS FOREST.

Very little work has been done at the Makiki or Tantalus forest, outside of stationing a laborer there to look after fires, keep the trails clean, and protecting the trees. The greater part of this tract was turned over to the U. S. Government and is now used as an Experimental Station. About thirteen acres of the forest has been cut down to make way for experimental work. Mr. E. M. Griffith, the U. S. Expert Forester, in his report says: "The reforestation of Tantalus by the Department of Agricultural and Forestry is an unusually fine piece of work very successfully carried out." The principal trees growing in this Tantalus forest are:

ACACIA DEALBATA—Silver Wattle.
ACACIA DECURRENS—Black Wattle.
ACACIA MELANOXYLON—Australian blackwood.
CAMPHORA OFFICINARUM—Camphor tree.
CASUARINA EQUISTIFOLIA—Ironwood.
CRYPTOMERIA JAPONICA—Japanese Cedar.
EUCALYPTUS—Several species.
GREVILLEA ROBUSTA—Silk Oak.
SYNCARPIA LAURIFOLIA—Turpentine tree.
TERMINALIA CATALPA—Tropical Almond.

It is only since 1893 when the Board of Agriculture and Forestry was organized that any record has been kept of the different kinds of trees planted in the Tantalus forest. Previous to that date it is known that several varieties of eucalyptus and monkey pods were planted. Commencing with the year 1893 the system of planting, as regards distance apart, the selection of the fast growing species, the different kinds producing the most valuable timber, were the main objects in view. The general European system was followed, it having proven after many years

of experience to be the best. The planting was done close. This met with some objection by a former Commissioner, but Expert Forester Griffith strongly approved of it when he visited this forest. The vigor and growth of many of the various species growing on Tantalus varies a great deal in different soils, also in sheltered and exposed places. For instance, trees planted in the bottom of the gulch where the soil receives the wash from the higher lands, and where they are sheltered from the winds, will make double the growth of those planted on the tops of ridges, in the same time. Then again hoeing and cultivating around the trees will increase the growth, but this is impracticable with trees in exposed places, for the reason, if kept cultivated, and the soil kept soft around their roots, they are apt to get uprooted during a wind storm, especially if the soil is very wet. The grass is cut away, leaving the soil undisturbed. When the tops of the young trees get above the grass, they are large enough to take care of themselves. The silver, black and golden wattles are very fast growing trees, making in five years a height of twenty-five feet, with the diameter of from five to seven inches at three feet from the ground. The acacia melanoxylon has grown well on Tantalus, reaching a height of twelve feet, with diameter of five inches at three feet from the ground, in five years. This is an excellent forest tree, its timber resembling our native koa, and it is frequently called foreign koa. The ironwood has grown to a height of twenty-five feet in five years. The Japanese cedar is a very handsome tree, but needs shelter. The eucalyptus species, lemon gum, sugar gum, stringy bark tree, blue gum, swamp mahogany and manna gum, have all about the same rate of growth, attaining a height of from thirty to thirty-five feet in five years, and from six to eight inches diameter, at three feet from the ground. The silk oak is another valuable forest

tree running up eighteen feet in five years. The turpentine tree has done well on Tantalus.

Other trees of less value as forest trees, to be found in Makiki forest at lower elevations are:

Acacia Albizzia.
Acacia Lophantha.
Albizzia Lebbek—Siris tree.
Albizzia Saman—Monkey pod.
Brachychiton Acerifolium—Australian flame tree.
Calophyllum Inophyllum—Tall tree, white flowers.
Casuarina Glauca.
Cuppressus Macrocarpa—Monterey Cypress.
Caesalpinia Haematoxylon—Logwood.
Erythrina Umbrosa.
Erythrina Lithosperma.
Pinus Insignis (Monterey pine).
Schinus Molle—Pepper tree.

Some of the above mentioned trees might do better at a higher elevation.

A number of Camphora Officinarum (C. tree) and a few Manihot Glaziovi (Ceara rubber), were planted at an elevation of from four to five hundred feet above sea level, on land now used by the U. S. Experiment Station. The camphor reached a height of five feet in five years, and the ceara rubber about ten feet. Under more favorable circumstances, both kinds might attain double that growth, in the same time. This land, in certain seasons, suffers very much from drought.

A large number of fruit trees, at different elevations, varying from eight to twelve hundred feet, were also tried, viz:

Artocarpus Integrifolia—Jack fruit.
Citrus Aurantum—Orange, 15 kinds.
Citrus Limetta—Lime, 4 kinds.

MANGIFERA INDICA—Mango, 2 kinds.
MACADAMIA TERNIFOLIA—Nut tree.
PERSEA GRATISSIMA—Avocado pear.

The above were planted on both sides of the gulch, below the quarters on the lands now occupied by the U. S. Experiment Station, and on property owned by the Coney estate and leased by the Government, at that time.

The mango, pear and jack-fruit grew well, but the citrus tribe did not make much growth, although, for several years, they looked healthy.

Other fruit trees planted above the forest, at elevations of from twelve to fourteen hundred feet, are as follows:

Almonds—4 kinds.
Olives—4 kinds.
Permission—4 kinds.
Japanese chestnut—4 kinds.

The olives are eight feet high and looking healthy, while the other kinds are a complete failure.

There was also planted along the side of Makiki stream, two kinds of Litchi, four kinds of fig, and a number of Florida peaches, looking fairly well.

A number of Burmah bamboo from seed, two kinds of sisal, and a few Fourcroya longaeva, were also planted on lands now occupied by the U. S. Experiment Station, and are growing well.

The following were also planted:

ABIES CEPHALONICA—Ionian Islands.
" CILICICA—Asia Minor.
" NORDMANNIANA—Crimea.
" PINSAPO—Spain.
ACACIA CAVENIA—Chile.
" ELATA—Australia.
" FLEXICAULIS—Southern Texas and Mexico.
" LONGIFOLIA—Australia.

Acacia Penninervis—Australia.
" Pravissima—Australia.
" Retinodes—Australia.
Acer Campestre—Northern and Middle Europe.
" Negundo—Eastern North America.
" Rubrum—Eastern North America.
" Saccharium—Eastern North America.
Albizzia Fastigiata—South Africa.
" Julibrissin—Asia Minor.
" Moluccana—Moluccas.
" Occidentalis—Lower California.
" Odoratissima—India.
Arancaria Imbricata—Chile.
Casuarina Cunninghamiana—Queensland.
Casuarina Stricta—Australia.
Catalpa Bignoniodes Eastern North Ameria.
" Kaempferi—Eastern Asia.
" Cedrela—Eastern Asia.
" Sinensis—Eastern Asia.
Cedrela Dugesii—Mexico.
" Flessilis—Brazil and Paraguay.
" Odorata—Cuba.
" Serrata—Himalaya.
" Sinensis—China.
Cedrus Atlantica—Northern Africa.
" Deodara—Himalaya.
" Lebani—Asia Minor.
Celtis Kraussiana—Natal.
" Sinensis—China and Northern India.
Corynocarpus Laevigata—New Zealand.
Ciadopitys Verticillata—Japan.
Dalbergia Latifolia—India.
" Lissoo—India.
Dammara Alba—Southern Asia.

Enterolobum Cyclocarpum—Cuba.
Erythrina Bogotensis—Columbia.
Erythrina Caffra—Natal.
Erythrina Insignis—South America.
Eucalyptus Ficifolia—Australia.
" Marginata—Australia.
" Ramelina—Australia.
" Rudis—Australia.
Ficus Chauvieri—New Caledonia.
" Cunninghamii—Queensland.
" Palermi—Northwestern Mexico.
Frascinus Velutina—Arizona.
Juglans Nigra—Central States.
Libocedrus Decurrens—California.
Liniodendron Tulipifera—Southern States.
Machaerium Tipa—Southern States.
Maytenus Boaria—Chile.
Michelia Champaca—India.
Paulonia Impirialis—Japan.
Persea Indica—Canary Islands.
Pithecolobium Brevifolium—Northern Mexico.
Pittosporum Rhombifolium—Queensland.
Populus Pyramidalis—Europe.
Pterospermum Acerifolium—India.
Quercus Garryana—Oregon.
" Incana—India.
" Robur—Europe.
" Sober—Southern Europe.
Salisburia Adiantifolia—Japan.
Sequoi Gigantea—California.
Sequoi Simpervirens—California.
Sterculia Acerifolia—East Australia.
Sterculia Gregori—Australia.
Tristania Conferta—Queensland.
Widdingtonia Whytel—Eastern Africa.

The foregoing were given a fair trial but without success. None grew well enough to warrant recommending them for general forest planting. A large number of spruces and pines were also tried, both in Makiki forest and in Kau. Mr. David Haughs, the forester, coming as he did from a country where spruces and pines grew to perfection, naturally started in with the trees that he had been accustomed to growing and caring for. His first experience was at the Hutchinson plantation in Kau. Arriving there about twelve years ago with a large box of tree seeds, consisting of ash, beach, birch, elm, maple, oak, etc., and a large number of spruces and pines, he started in to change the vegetation of the Islands. Everything looked favorable, the soil and climate seemed all that could be desired, and he had high hopes that he would succeed in making a good percentage grow of the many different kinds. But failures and disappointments were in store for him. They were tried at elevations ranging from eight hundred to two thousand feet, above sea level.

Most of the seeds sprouted and looked well for a short time, but signs of decay soon set in, which showed plainly that they were not at home, in Hawaii, at least, at low elevations. Altogether, over one hundred kinds of pines were tried in Kau, and on Tantalus, at elevations, varying from eight hundred to two thousand feet. They all followed the same fate, some of them keeping alive until they were about a foot high and a year and a half old, then they die. The ash, beach, birch, elm, maple and oak were tried at the same elevations as pines, but without success.

Although the above named trees were not a success, at elevations under two thousand feet, still one must agree with Expert Forester Griffith, when he says that

some of the pines may do well on the higher slopes of our mountains. A good specimen of one of the Needle pines can be seen at Mr. Samuel Parker's, Mana, Hawaii, at an elevation of something over three thousand feet. Another can be seen at Mr. Aiken's place on Maui. The average yearly planting of trees, in Makiki, from 1893 to 1897, was 30,000, the distance apart, each way, being six feet. The number per acre being 1,210.

Pines and spruces tried in Kau and Makiki, at elevations varying from eight hundred to two thousand feet, are as follows:

ABIES.

The Spruce Fir—

Abies Alba—The White Spruce, North America.
" Alcoquiana—Alcocko Spruce, Fusi-yama, Japan.
" Brunoniana—The Indian Hemlock, India.
" Canadensis— The Hemlock Spruce, Carolina to Hudson Bay.
" Douglasii—Douglas Spruce, California.
" Taxifolia—Yellow Douglas Fir, Mexico.
" Excelsa—The Norway Spruce, Europe.
" Inverta—The pendulous branched Spruce.
" Maxwelli—Maxwell's Spruce, North America.
" Hookeriana—Sir W. Hooker's Spruce, California.
" Jezoensis—The Jero Fir, China and Japan.
" Menziesii—Menzies Spruce, California.
" Mertensiana—The Hemlock Spruce, California.
" Microsperma—The small seeded Spruce, Japan.
" Morinda—The Himalayan Spruce, Himalayas.
" Nigra—The black Spruce, North America.
" Obovata—The Obovate Spruce, Coast of Black Sea.

ABIES ORIENTALIS—The Oriental Spruce, Crimea.
" POLITA—Japanese Spruce, Japan.
" SCHRENKIANA—Schrenk's Spruce, Eastern Siberia.

PICEA.

The Silver Fir Tribe—

PICEA AMABILIS—(The lovely Silver Fir), Northern California.
" BALSAMEA—Balm of Gilead, Fir, Canada.
" BRACTEATA—Silver Fir, Upper California.
" CEPHALONICA—Mount Enos fir, Upper California.
" CILICICA—Chilenean fir.
" CONCOLOR—Self colored silver fir, New Mexico.
" FIRMA—Japanese silver fir, Japan.
" FRASERI—The double Balsan fir, Carolina.
" HUDSONICA—Silver fir, Hudson Bay Territory.
" GRANDIS—The Grand silver fir, Frazier river, Cal.
" LASIOCARPA—Woolly scaled silver fir, Northern California.
" MAGNIFICA—The superb silver fir.
" NOBILIS—The noble silver fir, Northern California.
" NORDMANNIANA—Nordman's silver fir, Crimean Mountains.
" NUMIDICA—Algerian silver fir, Mountains of Kabylia.
" PECTINATA—Common silver fir, Alps.
" PECTINATA PENDULA—Drooping silver fir, Ville d'avraz.
" PICHTA—The pitch silver fir, Siberian Mountains.
" PINSAPO—Pin apo fir.
" RELIGIOSA—Sacred silver fir, Mexico.
" VEICHII—Vetch's silvery fir.
" WEBBIANA—Captain Webb's Indian fir, Himalayas.

PINAE OR PINES USUALLY HAVING BUT TWO LEAVES IN A SHEATH.

PINAE AUSTRIACA—The Austrian pine, Lower Austria.
" BANKSIANA—Sir Joseph Bank's pine, North America.
" BOLANDERII—Bolander's pine, California.
" BRUTIA—The Calabrian cluster pine, Mt. Aspero, Calabria.
" CONTORTA—Twisted branched pine, N. W. Coast of N. America.
" DENSIFLORA—The dense flowered pine, Japan.
" HALEPENSIS—The Aleppo pine, Apennines.
" INOPS—The New Jersey pine; in various parts of N. America.
" LARICO—The Corsican pine, Mt. Etna.
" CALABRICA—The Calabrian pine, Sila in Calabrica.
" CARAMANICA—The Caramanian pine.
" CONTORTA—Corsican pine.
" MASSONIANA—Masson's Japan pine; Island of Nippon, Japan.
" MITIS—Yellow pine, New Jersey, Maryland and Virginia.
" MURICATA—The Bishop's pine, San Louis Obispo.
" PALLASIANA—The Taurin pine, Crimea.
" PINASTER—The cluster pine, Europe.
" BERMUJA—The Bermuja pine.
" HANULTONII—Lord Aberdeen's pine. Nice.
" PINEA—The Italian stone pine, south of Europe.
" PENNILIO—The dwarf or mountain pine. Alps.
" PROSTATA—The knee pine, Styrian Alps.
" UNCINATA—The hooked cone pine. Alps.
" PENGENS—The table mountain pine, North Carolina.
" PYRENAICA—The Pyrenean pine, South of Spain.

PINAE SILVESTRIS—The Scotch fir.
" ALTAICA—The Altai Scotch fir.
" NANA—The Pigmy Scotch fir.
" TABULAEFORMIS—Tabular formed pine. Pekin.

TERNATAE OR PINES USUALLY WITH THREE LEAVES IN A SHEATH.

TERNATAE AUSTRALIS—The southern pine. Southern States of America.
" BENTHAMIANA—Bentham's pine. California.
" BUNGEANA—The lace bark pine.
" FREMONTIANA—Co. Fremont's nut pine. Hamaly.
" GERARDIANA—Captain Gerard's pine.
" INSIGNIS—The remarkable pine. California.
" JEFFREYI (Jeffrey's pine), California.
" LONGIFOLIA—Long leaved Indian pine, Himalaya Mts.
" MACROCARP—The large coned pine. St. Lucia, Cal.
" PARRZANA—Mt. Gambier Parry's pine.
" PONDEROSA—The heavy wooded pine. California.
" RADIATA—The radiated cone pine. California.
" REGIDA—The stiff leaved pine. Upper California.
" SABINIANA. Mr. Sabin's pine. Upper California.
" TUBERCULATA—The Knol coned pine. Upper California.

QUINAE OR PINES USUALLY WITH FIVE LEAVES IN A SHEATH.

QUINAE ARISTATA—The bearded scaled pine. Pike's Peak, N. A.
" AYACAHAITE—The Ayacahaite pine. Mexico.
" BALFOURIANA—Dr. Balfour's pine. Northern California.
" CEMBRA—The Swiss stone pine. Alps.
" MANCHURICA—The Manchurian pine.

QUINAE PINNILA—The dwarf cembra pine, Eastern Siberia.
" SIBIRICA—The Siberian stone pine. Siberia.
" DEVONIANA—The Duke of Devonshire pine. Mexico.
" EXCELSA—The lofty Bhotan pine. Himalayas.
" FLEXILIS—The wavy branched pine. California.
" HARTWEGII—Hartweg's pine. Mexico.
" KORAIENSIS—The Corean pine. Kamschatka.
" LAMBERTIANA—Lambert's pine. Northern California.
" LONDONIANA—London's pine. Mexico.
" LEIOPHYLLA—The small leaved Mexican pine. Mexico.
" MACROPHYLLA—The small leaved Mexican pine. Mexico.
" MONTEZUMAE—Rough barked Mexican pine. Mexico.
" MONTICOLO—The Californian mountain pine. California.
" PARVIFORA—Small flowered Japanese pine. N. Japan.
" PENCE—The Greek stone pine. European Turkey.
" PSEUDOSTROBUS—The false Strolus pine. N. America.
" STROBUS—Lord Wegmouth's pine.
" TORREYANA—The crest seeded pine. Lower California.

An appropriation of $500.00 was made by the last Legislature for building laborer's quarters on Tantalus, but it has not been used for the reason that I was enabled to make arrangements with the Coney estate to house our laborer.

NUUANU FOREST STATION.

The principal forest work is being carried on in the upper part of Nuuanu Valley from Luakaha to the Pali where, since the latter end of 1898, nearly two hundred and fifty thousand different trees have been planted out. This work is in charge of Mr. David Haughs, Forester, who lives at the station and has ten laborers under him. During the period additional laborer's quarters have been built, and the forester's cottage has been repaired, added to and painted. The trees planted out in Nuuanu are subject to heavier winds than those on Tantalus, consequently the growth has been slower. In spite of the violent winds many of the trees are standing up quite high, and in a few years there will be a fine forest in this beautiful valley. On the slopes, either side of the valley, may be seen a luxuriant growth of koa, kukui and ohia. Expert Forester Griffith spoke very highly of the Nuuanu forest work after going over the ground. This tract, except a few spots sheltered by small ridges, is exposed to the full force of the wind which blows through the gap, at the Pali, with terrific velocity at times. During the last severe gale many of the young trees were stripped of their leaves, which will retard their growth to a certain extent.

Several indigenous trees, the seeds of which were brought from the Island of Hawaii, suffered considerably from the heavy rains and winds, and if any success is going to be made in growing them in Nuuanu, they will have to be planted in sheltered places. Arrangements were made with Mr. E. P. Low of Puwaawaa, Hawaii, to collect seeds of the indigenous trees growing at his place, and send them when they were ready. Out of nineteen different varieties sent only eleven germinated as follows:

Alahee—Plectronia odorata. Leaves used for coloring matter for calabashes.

Aalii—Dodonaea viscora. Fine durable wood, leaves used for medicinal purposes, flowers used same as hops.

Aaka—Myoporum sandwicense. Bastard sandal wood. Durable for building purposes, used also for lama lama torches in fishing.

Ohia—Metrosideros polymorpha. Good firewood. Bark used for dye purposes.

Akia—Wikstroemia sandwicensis. A poisonous shrub, used in fishing. Leaves and seeds used medicinally.

Holei—Ochrosia sandwicensis. Used for coloring and medicinally. Wood preferred for canoe rims.

Uhiuhi—Caesalpinia Kauaiensis. A very hard reddish black wood, used for spears and agricultural implements.

Iliahi—Santalum freycinetianum. Sandal wood.

Kauila—Alphitonia ponderosa. A fine grained hard wood, red.

Kolea—Myrsine sandwicensis. Bark good for tanning purposes. Wood has also good cabinet or furniture qualities.

Lama—Maba sandwicensis. A hard durable wood, formerly used in heiau building. Produces an edible fruit.

The following varieties have been planted in Nuuanu Valley and are doing well, some of them exceptionally so:

Acacia Koa.

Acacia Melanoxylon—Australian Blackwood.

Afzelia Byrigate.

Bombax Cotton.

Silk Cotton.
Casuarina Equistifolia—Ironwood.
Catappa.
Eucalyptus—Several species.
Ficus Macrophylla—Rubber.
Grevillea Robusta—Silk Oak.
Java Plum.
Pride of India.
Parkia Africana.
Pinus Pinea—Stone pine.
Pinus Ponderosa—Yellow pine.
Pinus Maritimus—Cluster pine.
Pinus Torreyana—Soledad pine.
Poplar.
Syncarpia Laurifolia—Turpentine tree.
Terminalis Arjuna.

Of all the trees planted in Nuuanu Valley none have done so well as the ironwood, which is a rapid grower and resists the strong winds. Owing to the wiry nature of its foliage it does not cast a dense shade. Dr. John Gifford, assistant professor, of New York State College of Forestry in the March, 1902, number of "Forestry and Irrigation," says: "Scattered almost everywhere throughout the tropical coast towns of the world one sees Casuarina Equistifolia—Ironwood. At Palm Beach, Nuaini, and other Florida towns, this tree has been extensively planted, and is growing with magical rapidity. It is sometimes called the Loa tree and is also known as Beefwood. It is one of the most valuable forest trees of the world. It is easily propagated, grows rapidly, and in places where few other trees would thrive, plantations of this tree on the Madras coast are now beautiful and valuable forests."

The trees in Nuuanu are subject to considerable more wind than those on Tantalus, consequently are a little slower of growth. The elevation in Nuuanu where planting is going on is from ten to twelve hundred feet above sea level. One of the best forest trees in Mexico is the Taxodium Mexicanum, where it attains a height of one hundred and twenty feet. In Nuuanu where several have been growing for about three years, they are simply straggling shrubs. They would do better in less exposed places. This is not the only instance of good forest trees not doing well in Nuuanu.

HAWAIIAN FORESTS.

The opening of the year was marked by a disastrous fire, in the district of Hamakua, Island of Hawaii. It started on July 3rd, through the carelessness of a native who was burning brush on his kuleana and let it get beyond his control, spreading into the forest adjoining his land. The fire continued with more or less vigor until the beginning of October when heavy rains set in, which eventually put it out. Forester Haughs made two trips to the scene of the fire, one early in August, the other in September, with Mr. J. H. Boyd, Superintendent of Public Works, and Mr. Marston Campbell, his assistant. Mr. Haughs approximately estimated the amount of land covered by the fire at about thirty thousand acres, consisting of government lands, leased government lands and private land.

The plantation managers, in the district, sent out large gangs of men to try and check the flames. As a consequence, a large amount of money was paid out, and the managers rely on the government to place the amount of their bills before the next Legislature. I feel sure that when all the particulars are laid before the Legislature,

there will be no delay in the payment of the various claims, which are considered just ones. In his report on the fire, Forester Haughs is of the opinion that there is no place in the islands more in need of a forest reserve than Hamakua, and the sooner the better. He thinks the burned district and the remaining portions of forests in Hamakua should be retained as a forest reservation. During the last drought in the district, water for domestic use had to be carted for eight and ten miles, and the oldest inhabitants do not remember such a scarcity of water. There is evidence of their having been continual running streams, in the Hamakua district, just as the streams continue running in the Hilo district.

The key to the whole situation is the tampering with the water shed. The forest area has been gradually getting smaller for years. The agriculturist has been creeping off the forest from the lower side, and the ranchmen down from the upper side. This must stop if the existing sugar planters and the small farmers are to continue their industries. The assistance of the government is needed in reserving the forests and protecting these industries. This question is dwelt upon in connection with Expert Forester Griffith's report.

Mr. Haughs made a trip to the forests in the Hilo and Puna districts, and also visited the district of Makawao, Maui.

VISIT OF U. S. EXPERT FORESTER.

In December, 1901, Mr. Edward M. Griffith, Assistant Forester, Bureau of Forestry, U. S. Department of Agriculture, came to the Islands, remaining here about two months, during which time he visited the forests on the islands of Oahu, Hawaii, Maui and Molokai.

On the trips to Maui, Molokai and Hawaii, he was accompanied by Forester Haughs. While staying in Honolulu, I arranged a lecture by Mr. Griffith, on Hawaiian forests, at the Y. M. C. A. hall, which was largely attended. After reading President Roosevelt's message, commenting on the value of forests, which he said their preservation was a necessity, Mr. Griffith spoke of conditions in the western part of the United States where timber had been cut away from the headwaters, the people believing the supply almost unlimited, until mountains were denuded. The people have now demanded that the supplies be protected. In the Black hills where timber and water were once plentiful, the water supply has almost been cut off owing to the denudation of the timber lands. The rapidity of denudity and the rapidity of growth, in the islands, had surprised Mr. Griffith, who said further that the government should keep a very tight control over the opening up of the forests. The entire lecture was most instructive and thoroughly appreciated by the large audience.

Mr. Griffith's visit was a very important event in the history of forestry in the Territory. The preliminary examination of our forests brought forth a very able report from him, which is in your hands. His recommendations are worthy of the highest consideration, and I strongly recommend they should be the basis of an exhaustive forest bill to be placed before the next Legislature for its approval with liberal appropriations. As Mr. Griffith said in his lecture, "this is not a question of leaving forests for posterity to enjoy, it is a question of now." Mr. David Forbes, manager of Pacific Sugar Mill, a trained forester himself, is very much in favor of carrying out Mr. Griffith's reommendation. Special reference is made by Mr. Griffith in his report on the Hamakua forests

where the large fire took place. The question is of such vast importance that I would specially call your attention to the following extracts from Mr. Griffith's report fully endorsing them, viz:

"As the forests of the Hawaiian Islands contain such a very limited amount of merchantable timber, the question of the best methods of lumbering does not enter into consideration; the whole problem is conserving the water supply which depends upon the preservation of the existing forests and restocking some of the denuded slopes either by natural reproduction or planting."

"In order to place the work upon a thoroughly efficient basis it will be necessary for the government, planters, and others owning or leasing land upon which water is the chief consideration to co-operate and see to it that the forests are thoroughly protected."

"The government should assist the plantations in every possible way to protect the forests and incorporate in all future leases a provision that all important forest areas shall either be fenced by the lessee or all cattle absolutely excluded."

"The whole question on the island of Maui is protecting the existing forests; it is of the most vital importance to the plantations that these should be done at once and thus save the very large expense of artificial planting."

"In future the forest areas on Oahu should never be leased for grazing purposes and the lessees of cane and agricultural lands should be obliged by the terms of their lease, to build stock fences and keep them in repair."

Recommendation for the organization of a Forest Force. In order to thoroughly protect the forest areas and carry out the forest policy of the Government, the organization of a field force is extremely important. The following forest force which is similar to those in charge

of the forest reserves in the United States is recommended, viz: A forest inspector who shall be a practical forester and have charge of all government forest land and direct the work of the forest rangers. Four Forest Rangers who shall have had some practical training in forestry, understand lumbering and tree planting, with ranges as follows: One on the Island of Oahu; one on the Island of Hawaii; one on the Island of Kauai; one for the Islands of Maui and Molokai."

"Their duties should consist in patrolling all government forest land within their ranges and enforcing the terms of the lease, superintending the construction of all government fences, acting as fire wardens, and taking charge of all the planting."

"If thoroughly competent men are appointed, such a force should prove wonderfully efficient in protecting and building up the forest reserves."

DIVERSIFIED INDUSTRIES.

SISAL—AGAVE SISALANA.

Soon after the establishment of the Bureau of Agriculture and Forestry, in March, 1893, the Commissioner, Mr. Joseph Marsden, began to look into the matter of introducing such new economic plants as seemed adapted to our soil and climate, with the hope that new industries might be started to supplement the sugar industry. In going into the matter, he was much impressed with the suitability of the sisal plant for profitable culture in the Islands.

It is well known that there is a large acreage of land on all the islands of this Territory that does not have sufficient rainfall to allow either sugar, coffee, or anything that requires a supply of moisture throughout the

year, to be grown. The Agave Sisalana seemed to offer the only opportunity to bring this class of land into profitable use. The sisal plant, when once started, grows independent of moisture. It will grow on the rockiest of soils and requires less cultivation or care than perhaps any other economic plant. When once this plant reaches the age when the leaves can be cut for fibre, it yields a constant supply of fibre for years. While the yield per acre of fibre from the sisal plant is not large—it should yield at least 1000 lbs. of dried fibre per acre each year—the expenses of cultivation and manufacture are so small that a sure profit seems assured. This, of course, implies that a sufficient acreage of sisal plants have been planted to justify the installation of the requisite machinery for the extraction of the fibre; the larger the plantation, the more certainty of success. A plantation should not be less than 500 acres and planting should continue until 1500 or 2000 acres are planted.

The plant reproduces itself by constantly sending up shoots from the roots, and by sending up a pole from the center. This pole bears several thousands of small bulbs each one of which will, when planted, grow into a sisal plant.

After poling and bearing the young bulbs, the parent plant dies. In cultivation the plant is prevented from poling by cutting the leaves for fibre. If the leaves are not cut, the plant will pole and die in four or five years, from the time it has been set out, but if the outside leaves are regularly cut as they mature, the plant will go on yielding fibre for fifteen years or more.

As to the introduction of sisal, the first plants, some 20,000, were procured from Reasoner Bros., of New Orleans, and later 1000 small bulbs were imported from the Bahamas. These latter were imported for the pur-

pose of making sure that the plants supplied by Reasoner Bros. were the true sisal plants. They proved to be exactly the same species of plants.

A large number of these plants were set out near Ewa, and today we see there a well equipped sisal plantation controlled by the Hawaiian Fibre Co., Limited, with Mr. A. H. Turner, manager. Early in the year Mr. Eric Knudsen, of Waimea, Kauai, decided to go into the planting of sisal as he had a large tract of suitable land for its growth. He will put in 300,000 plants. Hon. F. W. Beckley has just started a large sisal plantation on his land, Island of Molokai. Correspondence has been opened with other parties urging them to go into the business, and I believe before the next period closes there will be a large number of sisal plantations started.

At Ewa the sisal plantation looks well and the Company are now installing their machinery. Manager Turner says that the sisal industry here has now reached that stage of development where to label it "a success" is no longer an embarrassment to its promoters, and though it is yet limited to a few hundred acres on this island, its general distribution in an experimental way has been such as to reach all kinds of soil, and not in a single instance has it failed when properly treated. The result of these experiments together with the prices paid for fibre during the past four years is certainly sufficient to warrant the assertion that sisal will pay a handsome profit to its cultivators, provided the average judgment is exercised during its development, which is at least three years from the time of planting.

Figures from Mr. Turner show that, since the beginning of 1898, the prices of sisal fibre have ranged from 5 to 22 cents per pound. Growers in the West Indies have estimated the cost to produce sisal as low as 2 1-2 cents per pound. A deduction from the figures would

show enormous profits, but the cost to grow and market fibre. is so dependent upon locality and various other conditions that a statement on that subject will be of little value until the culture of sisal in Hawaii has become more general. Present prices (nine cents per lb.) would seem to justify a very liberal expenditure, but the time required for returns in the sisal business demand the practice of strict economy in order to meet any possible changes that may come about during its progress.

I can be pardoned in referring to the fact that this new industry, which promises so much, was started and urged by this department and if it had done nothing else, the appropriations for its maintenance made by the Legislature have been well spent.

CASTOR BEAN—Recinus Communis.

At the foot of the Nuuanu Pali, in the district of Koolau, is situated the Castor Bean plantation of Mr. C. Koelling. He has, at the present time, eighty acres under cultivation, but intends increasing it to one hundred and fifty acres. The plants are planted 12 feet apart in the rows, the rows being 24 feet apart. The best results are obtained with these distances after experimenting. The calculated yield from three year old plants is 4000 lbs. of beans per acre, from the best land, and on poorer land, 3000 lbs. Percentage of oil by hydraulic pressure, 45 per cent.; by benzine process, 55 per cent. The mill built by a Glascow firm has a capacity of one ton of beans a day. The benzine machinery is from Austria, patented by Prof. Martz. In selling 2000 gallons of castor oil to a San Francisco firm, Mr. Koelling received for No. 1 grade, 95 cents per gallon; for No. 2 grade, 89 cents per gallon. He now sends all his oil to Hackfeld & Co., and there is always a market

for it. The plantation looks well, and Mr. Koelling feels much encouraged. He says the cut worms destroy many of his plants, and this seems rather strange, when it is remembered that botanists recommend the castor bean plant for keeping off locusts and other noxious insects from plantations, owing to its poisonous nature.

PINEAPPLE CULTURE.

There has been considerable expansion in the pineapple industry during the past year. The Pearl City Fruit Company have largely increased their canning business, and have put out this season, 6200 cases, which go to the San Francisco market. This means close to one hundred and fifty thousand cans of fruit, bringing in between twenty-three and twenty-five thousand dollars. They grow the smooth Cayenne and put up the pines mostly as sliced. Grated pines does not seem to be popular in the market of the Western States. Sliced pines bring from $2.00 to $2.25 per dozen cans; grated $1.40 per dozen. The Wahiawa Colony of farmers have given up a large acreage to the cultivation of pineapples, and they now have a store in the central part of Honolulu, where not only fine large pines can be obtained, but also other garden produce of the best quality. Two other companies have also gone into the business of growing pines, at Wahiawa, and one of them will shortly erect canning machinery. Now that the Wahiawa Colony have completed their ditch and get all the water they want, great things may be expected of them in the near future. The colony deserves success.

VANILLA BEAN.

Much correspondence has been received and many inquiries made in regard to the cultivation of the Vanilla

Bean. It is known that in the Seychelles Islands it is a very prominent industry and there seemed to be no reason why it could not be the same in these tropical Islands. That Vanilla will grow well here has been proven, but as yet no one has been found who would go into the industry to any extent. There is a large profit to be made every year in a few acres of Vanilla plant. Early in the year a Mr. E. H. Edwards arrived from Ceylon and is an expert in the cultivation of Vanilla. He finally went to Napoopoo, Hawaii, with the intention of going largely into the business. A letter from him as the period closes states that he has had much trouble in getting suitable cuttings. He had just received some from Samoa, the only ones that were worth planting. Some seven thousand had been lost in transit. Mr. Allan Herbert has grown at Kalihi and brought to us some very fine beans. So far, it may be said this industry is in its infancy, in Hawaii, but it will not be lost sight of by this department, as your Commissioner is in correspondence with several firms relative to getting a large number of cuttings.

UNITED STATES AGRICULTURAL EXPERIMENTAL STATION.

The tract of land, about 222 acres running from the base of Punchbowl well up to the top of Tantalus, with an elevation of from 70 to 1400 feet, is used as an Agricultural Experiment Station with Mr. Jared Smith, as special agent in charge. During the year the principal work has been the clearing of the land selected for planting, erection of special agent's house, office and laboratory, stables, outbuildings, laborers' quarters, installation of a pumping plant, and erection of water tanks. Some grading and road building has also been done. T.

F. Sedgwick and F. H. Counter, are assistants, and D. L. Van Dine, entomologist. The Station has an office in the Capitol Building. The uses of this, as of all experiment stations, Mr. Smith says, will be the introduction of new forage plants, fruits and trees likely to flourish in this climate, and the conserving and improvement of local growths with regard to the highest development of their economic values. The scope is a wide one embracing botany, geology, entomology, and a knowledge of many of the sister sciences. The work of the station in addition to the mere growing of the fruits and other products will be to study conditions closely and print bulletins, which will go everywhere, showing just what is being done; bulletins which will show the farmers how to proceed to accomplish the same results that the station obtains. In time men will be sent out, who will analyze soils, study plant diseases, and look into irrigation matters. While the erection of the buildings was going on Mr. Smith made several trips to the other Islands. Your Commissioner is indebted to Mr. Smith for many courtesies. His appropriations running out some time before the fiscal period, I offered Mr. Smith the use of any of our laborers in case he needed them for the protection of plants already set out, needing care.

HAWAIIAN GRAZIERS' ASSOCIATION.

A very important organization formed during the year is the Hawaiian Live Stock and Breeders' Association. At the initiatory meeting, Mr. Eben P. Low of Puwaawaa, gave an address outlining the objects of the Association, such as the improvement of the cattle and horse breeding industry; to adjust grievances existing among the graziers; to find and devise ways and means for developing pasture lands, by planting such grasses as may

be adapted to various locations, and to preserve or reforest any lands that are not utterly denuded by stock or insects, replanting such classes of trees as will be beneficial, such as the kiawe for lowlands, and the mamane for uplands, or other valuable trees. The usefulness of such an Association is far reaching.

FARMERS' INSTITUTE OF HAWAII.

During the month of January, 1902, at Wahiawa, the first "Farmers' Institute" of Hawaii was organized with a good membership, the officers elected being President, Jared G. Smith; Vice President, T. F. Sedgwick; Secretary and Treasurer, D. L. Van Dine. An impetus to the small farming industry will undoubtedly be the result of this organization. At the meetings papers are read on various agricultural subjects, and a general discussion follows.

DISTRIBUTION OF SEEDS.

In 1900 the U. S. Congress appropriated the sum of $130,000.00 for the purchase and distribution of valuable seeds. In 1901 the appropriation was increased to $170,000.00. It has been truthfully said, that the value of seed and plant introduction to the Agriculture of the United States is very great. All who are familiar with its results, must agree with this. It would be impossible for any one to estimate in dollars the benefits already derived, much less the vastly greater benefits which will come with the future. The introduction of one new variety is worth more to the Territory than the cost. Our delegate in Congress is entitled to so many packages of seeds. I requested him to have them sent direct to this department which was done, and it has enabled me to distribute several thousand packages throughout the

Territory. From returns received I am satisfied the seeds were of the best, and have been very beneficial. The most of them were vegetable seeds such as squash, spinach, onion, turnip, carrot, lettuce, parsley, beet, cabbage, tomato, corn, pea, bean, etc. Having an appropriation for the importation of seeds, I have introduced and distributed several thousand pounds of sorghum, alfalfa, and crimson clover seed. Have also distributed several hundred pounds of Burbank seed potatoes and many varieties of forest tree seeds.

Through the courtesy of the Japanese Consul I was enabled to obtain several bags of seed of Kiushi rice, which has been distributed to rice planters, the result of which will be known in the future. Dr. S. A. Knapp of the U. S. Agricultural Department, says of this rice, that under favorable circumstances it yields from 100 to 400 per cent more than any other rice. It yields 4 or 5 barrels per acre without any water except rain. He says the department never spent money that helped the country more than that spent in the importation of this rice.

PANICUM MOLLE GRASS.

When in Fiji, our entomologist noticed a grass growing which attracted his attention and upon making inquiries he found it to be the PANICUM SPECTABILE, and very much used by the planters there. He brought some seed, which was planted at the Forest Station in Nuuanu Valley, and there is now an acre, more or less, of it, growing finely. It was introduced from Para to the States and its correct name is PANICUM MOLLE, so Mr. Jared Smith informs me. It is cultivated in South America, in the West Indies and Mexico, and has been introduced into some of the Gulf States. It is grown with success on the high ridges of Florida, and wherever cultivated it is

most highly estimated and regarded as a very fattening pasture grass. It will produce an immense amount of forage. This grass has been pretty well distributed throughout the Territory and there is still a constant demand for it. The grass is sent out in bundles and takes root from nearly every joint. Dr. Shorey, the Government Chemist, gives me the following analysis of this grass:

Moisture	75.750	per cent.
Ash	3.230	" "
Fibre	6.850	" "
Fat (Ether extract)	0.300	" "
Protein (N. X. 6.25)	3.325	" "
Nitrogen free extract	10.545	" "
Food or fuel value	259.1	Calories per lb.

The food value of cane tops is 210.6 Calories per lb., of sorghum, 242.1 Calories per lb., by way of comparison.

IMPORTATION OF BENEFICIAL BIRDS.

In the early part of 1902, Mr. E. P. Low sent for a number of grosbeaks, a bird known to devour noxious insects, with the intention of liberating them in the forests at Puwaawaa, Hawaii. Many of them died before they reached the forest, and nothing more has been seen of those let loose. The subject of introducing woodpeckers came up in this connection, and I communicated with Prof. F. E. L. Beal, of the Biological Survey, at Washington. and several taxidermists. The matter was also talked over with Mr. W. A. Bryan of the Bishop Museum.

In a report of the Biological Survey published in 1895, it shows that the woodpeckers are decidedly beneficial. In the study of the stomachs of nearly 700 woodpeckers only one of the seven species examined—the yellow-bel-

lied—exhibited any questionable traits, namely, a fondness for the sap and inner bark of trees. Prof. Beal advised making an experiment with the "red shafted flicker" of the Pacific Coast, but I was confronted with the fact that it would be a matter of great difficulty to transport the birds to the Islands and being able to give them the proper food on such a long trip. Nothing further has been done, for the reason that everyone written to expressed the same opinion as regards transportation.

GOVERNMENT ENTOMOLOGIST.

Prof. A. Koebele, the Government Entomologist, is at the present time, in Mexico, where he was sent in April to find enemies for the Lantana Scale, ORTHEZIA INSIGNIS, which is affecting the plants on the Island of Maui. Up to the close of the period he has not sent in any report of his work. During his absence, I have been fortunate in making arrangements with Prof. R. L. C. Perkins, the Naturalist, to take charge of the inspection of plants and seeds coming in, and from the work he has already done we owe much to him for keeping out new insect pests.

BLIGHTS AND INSECT PESTS.

It was thought that during this summer season the Japanese beetle, ADORETUS UMBROSA, would appear in much less numbers than it did the previous years, owing to so many being inoculated with the vegetable fungus prepared by the entomologist. They do not seem to be so plentiful, which is in a measure judged by fewer complaints. The most troublesome blight that has made its appearance is the ERIOCOCUS, on the alligator pear, fig, and guava trees. About four thousand small black ladybirds, name yet unknown to our entomologist, caught

in Hilo, were scattered in and around Honolulu, but they have not done the work it was thought they would. Resin washes have been effective in many instances, and would be more so if those complaining of the blight would spend a little more time in using the washes. In spraying a tree it must not be expected that the blight would disappear the next day. It has to be sprayed several times, at intervals, yet some people think one application is all that is necessary. Resin washes can always be had from the Government Nursery.

The Lantana Scale, ORTHEZIA INSIGNIS, which was first found by G. P. Wilder, at Wailuku, Maui, in 1899, has spread nearly all over that island. Entomologist Koebele made trips to Maui and found that ranchers were distributing the scale around to kill their lantana. He advised them not to do that, and I issued a By Authority Notice requesting that all persons co-operate with our department, in its efforts not to spread the scale until it had been finally determined that it was not detrimental to other vegetation. Previous to the issuing of this notice in February, 1902, I learned that several parties, well known to us, had carried the Lantana Scale from Maui to the Island of Oahu. It was decided to send Prof. Koebele to Mexico to find beneficial enemies for the destruction of Lantana, and before leaving, he strongly opposed the spreading of the ORTHEZIA INSIGNIS, as he considered it dangerous to other vegetation. One box of affected lantana seeds from Mexico has arrived and is at present in care of Prof. Perkins, who will carefully watch the outcome. The lantana is one of the worst pests we have and a menace to the prosperity of agricultural industries. Some plantations pay out thousands of dollars every year in clearing lantana. It is much to be hoped that Koebele's visit to Mexico will end

in the destruction of all lantana in the Islands, and the preventing of its growing up again. I hopefully look to this end. If it should not, the investigations will not be given up.

At my request, Prof. Koebele prepared an article on the history of the Lantana Scale, which I have attached to this report.

There are many complaints coming in as to the ravages of the cut worm. This is a serious matter to the small farming industry. Experiments have been made at Nuuanu Forest Station, but as yet nothing has been found to effectually destroy the worms. As soon as the entomologist returns, he will be instructed to spend his whole time in trying to get rid of this pest.

IMPORTATION OF PLANTS FROM FOREIGN COUNTRIES.

If the same strict measures had been adopted several years ago, that are now in force, it is certain that the number of blights and noxious insects in the Territory would not have been so numerous as they are now. Through the courtesy of Hon. E. R. Stackable, Collector General of Customs, we are notified of the arrival of any plants and trees, from domestic and foreign ports. These cannot be removed from the wharf until after a thorough examination by our entomologist. If affected they are at once destroyed, no matter who they belong to. Only the other week some small trees came from Samoa. They looked healthy enough, but the packing they were wrapped in (moss) was alive with beetles, some of which Naturalist Perkins said he had not seen here before. The packing was at once burned and the young trees well washed with a resin mixture. As long as I am Commissioner, I propose to take the most drastic measures

to keep out any new blights and insect pests. I admit it is not pleasant for a person to import any rare plants and then have them destroyed just because there are a few insects, or a scale blight on them. The co-operation of the Custom House officials is very gratifying.

In order to more fully protect the Territory from plant diseases, blights and insect pests, I trust you will bring before the Legislature, the necessity of carrying out the intention of the laws in force, the necessity of appointing special agents of the department at the ports of Hilo, Mahukona and Kahului, as during the year many passengers land at those ports. The law provides that it should be the duty of the Commissioner to seek to prevent the introduction into the Territory of any plant disease, blight or insect pests injurious to any tree or trees, plant or plants, or vegetation, and to seek to exterminate any such diseases, blights or insect pests, now existing or hereafter introduced. These agents should be clothed with authority to act upon the arrival of any plants at the above mentioned ports, the same as the entomologist does here in Honolulu. An appropriation should be made to carry out this work. The greatest care is being exercised in watching the importation of plants from Samoa, and it may be that steps may have to be taken to prevent further importations from there.

COMPETITIVE EXHIBITION OF FRUITS, VEGETABLES AND PLANTS.

Notice was given in January, that an exhibition of fruits, vegetables and plants, under the auspices of this department, would be held the last week in July, 1902, in the Drill Shed, Honolulu. Exhibits are invited in the various divisions named in the following schedule:

DIVISION I.

Mangoes, alligator pears, pineapples, figs, watermelons, muskmelons, breadfruit, oranges, limes, lemons, papaias, grapes, guavas, peaches, strawberries, pohas, mountain apples, bananas and cocoanuts.

DIVISION II.

Sweet and Irish potatoes, yams, cabbage, cauliflower, celery, sweet and field corn, string and shell beans, beets, tomatoes, carrots, lettuce, turnips, radishes, onions, chili-peppers, taro, pumpkins and squash.

DIVISION III.

Coffee, pady, rice and sugar cane.

DIVISION IV.

Hay, sorghum,, guinea and buffalo grass, alfalfa, clover and panicum grass.

DIVISION V.

Potted palms, Hawaiian palm (Loulu) and ferns.

DIVISION VI.

Cut flowers, roses, asters, orchids and carnations.

DIVISION VII.

Ilima, carnation, maile and plumaria leis.

The date has been fixed for Monday and Tuesday, July 28th and 29th, and much interest is being shown in this coming exhibit. Two prizes are offered in every class, consisting of money and diplomas. The latter are litho-

graphed in six colors and quite tropical in design. If the exhibit is a success, and there is no doubt of it in my mind, it should lead the way to the holding of one every year, but on a much larger scale. It causes interest in agriculture and that is what is wanted here. Already, I have received word from Maui that watermelons weighing from forty to fifty pounds will be sent down, while the Wahiawa Colony say they have them about the same size, and also very large pineapples. It is gratifying to see the interest many Hawaiians are taking in the exhibitition by their coming in and asking questions concerning the exhibits. The competition for the prizes for the grasses will be keen among the farmers and ranchers.

AGRICULTURAL EDUCATION.

Under this heading reference must be made to the teaching of agriculture in several institutions in the Territory. Take for instance, the Kamehameha school for boys, here excellent work is being done. Mr. F. G. Kraus is the instructor and has a systematic plan of work. All the garden produce for the boys, girls and preparatory schools is grown by the pupils who take the course of agriculture. Experiments are carried out and noted, and considerable manual work is done. At the Hilo Boarding School, Hawaii, there is also a course of agriculture for the pupils, who grow all kinds of crops. The same may be said of the Lahainaluna Seminary, Maui. The boys of the Reform School are taught gardening. Instruction in agriculture is also given in the Normal School and more or less in every school throughout the Territory.

CONCLUSION.

In concluding this report, I would again call your attention to the importance of the preservation of the for-

ests; to the recommendations as set forth in Expert Forester Griffith's report, trusting that these important matters will be urged in your message to the Legislature. Sufficient, I think, has been noted to convince you that diversified industries are taking a sure step forward, and that everything possible is being done to combat blights and insect pests and to keep them out of the Territory. Every effort has been put forth by your Commissioner to carry out the existing laws, controlling this department, as faithfully and impartially as possible, and he hopes this report will meet with your approval.

Respectfully submitted,

WRAY TAYLOR,

Commissioner of Agriculture and Forestry.

———:o:———

REPORT OF THE GARDENER, GOVERNMENT NURSERY, FOR THE YEAR ENDING JUNE 30TH, 1902.

WRAY TAYLOR,

Commissioner of Agriculture and Forestry.

SIR:—

There has been a large increase in the distribution of plants during the year. The Nursery was closed the months of July, August and September, 1901, for needed repairs, and also to replenish the beds owing to the increased demand. On the 1st day of September, I was installed as gardener. The distribution days were increased from two each week to every day in the week except Saturdays. This made it more convenient for those re-

quiring plants. The classification which follows, shows what use the plants given out are being put to, viz: The beautifying of homes, increased supply of fruit for the table, and the re-clothing of barren hills. The demand for fruit trees has been large and could not be kept up with. I have been able to do considerable pruning of peach trees, the result being a heavier crop than is usually found here. Some of the branches had to be supported to carry the fruit. The flavor and size of the fruit were pronounced good. Experiments in this line will be kept up. The distribution of plants, etc., was as follows:

ISLAND OF OAHU.

September, 1901.

Shade trees, shrubs, etc.....	24	
Forest trees	120	144

October.

Palms	733	
Shade trees, shrubs, etc.	1,101	
Fruit trees	399	
Forest trees	408	2,641

November.

Palms	1,555	
Shade trees, shrubs, etc.....	1,938	
Fruit trees	458	
Forest trees	1,200	5,151

December.

Palms	719	
Shade trees, shrubs, etc	567	
Fruit trees	218	1,504

January, 1902.

Palms	599	
Shade trees, shrubs, etc.	635	
Fruit trees	183	1,417

February.

Palms	832	
Shade trees, shrubs, etc.	972	
Fruit trees	794	
Forest trees	1,080	3,678

March.

Palms	434	
Shade trees, shrubs, etc.	2,234	
Fruit trees	578	3,246

April.

Palms	777	
Shade trees, shrubs, etc.	1,084	
Fruit trees	490	
Forest trees	349	2,700

May.

Palms	900		
Shade trees, shrubs, etc	1,105		
Fruit trees	581	2,586	

June.

Palms	435		
Shade trees, shrubs, etc	1,200		
Fruit trees	548	2,183	
Grand total			25,250

ISLAND OF HAWAII.

November, 1901.

Palms	156	
Shade trees, shrubs, etc	141	
Fruit trees	22	319

December.

Palms	83	
Shade trees, shrubs, etc	55	
Fruit trees	11	149

January, 1902.

Palms	66	
Shade trees, shrubs, etc	81	
Fruit trees	33	180

February.

Palms	14	
Forest trees	180	194

March.

Palms	88	
Shade trees, shrubs, etc.	67	
Fruit trees	20	
Forest trees	649	824

April.

Palms	5	
Shade trees, shrubs, etc.	12	
Fruit trees	19	
Forest trees	435	471

May.

Palms	74	
Shade trees, shrubs, etc.	44	
Fruit trees	22	
Forest trees	240	380

June.

Palms	49		
Shade trees, shrubs, etc.	37		
Fruit trees	28	114	
Grand total			2,631

ISLAND OF KAUAI.

November, 1901.

Palms	54	
Shade trees, shrubs, etc	15	
Fruit trees	6	
Forest trees	1,150	1,225

December.

Palms	22	
Shade trees, shrubs, etc	2	24

January, 1902.

Palms	9	
Shade trees, shrubs, etc	20	29

February.

Palms	12

March.

Forest trees	1,534

April.

Palms	58	
Shade trees, shrubs, etc	42	
Fruit trees	78	178

June.

Palms	113		
Shade trees, shrubs, etc	32		
Fruit trees	12		
Forest trees	108	265	
Grand total			3,267

ISLAND OF MAUI.

October, 1901.

Palms	7	
Shade trees, shrubs, etc	36	
Fruit trees	7	50

November.

Palms	39	
Shade trees, shrubs, etc	66	
Fruit trees	7	112

December.

Palms	38	
Shade trees, shrubs, etc	17	55

February, 1902.

Palms	24	
Fruit trees	24	48

March.

Palms		48	

April.

Palms	21		
Shade trees, shrubs, etc	78		
Fruit trees	33	132	

May.

Palms		36	

June.

Palms	10		
Shade trees	15	25	
Grand total			506

ISLAND OF MOLOKAI.

November, 1901.

Shade trees, shrubs, etc	60		
Forest trees	254		314

April, 1902.

Forest trees			120

May.

Palms	72		
Shade trees, shrubs, etc.	181	253	
Grand Total			687

Respectfully submitted,

C. J. AUSTIN,
Gardener.

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REPORT OF THE FORESTER FOR THE YEAR ENDING JUNE 30TH, 1902.

WRAY TAYLOR,
Commissioner of Agriculture and Forestry.

SIR:—

I beg to submit herewith my report of the forestry work done the past twelve months (from June 30th, 1901, to June 30th, 1902). During that time, at your request, five visits were made to the other islands. The first was to Hamakua for the purpose of reporting on the destruction of the forest by fire which started on July 3rd, 1901, and was still burning when visited August 27th. A visit was made to Maui, in September, for the purpose of reporting on the condition of forests on the slope of Haleakala. The part examined was from Honomanu to Ulupalakua. A report was made on the condition of the forest along the Haiku and Spreckelsville ditches, also on the forest land above the Kula homesteads.

Along with Mr. J. H. Boyd, Superintendent of Public Works, and his assistant, Mr. Campbell, another trip was made to the burning forest of Hamakua, in October. A visit was also made in October to the Hilo and Puna districts.

From December 29th, 1901, to February 5th, 1902, I accompanied the U. S. Expert Forester, E. M. Griffith, on his preliminary examination of the Hawaiian forests. Commencing with Maui, Mr. Griffith was shown the forests on the slope of Haleakala, from Honomanu on the one side to the middle of the Kula district, on the other, then from Iao Valley to Lahaina.

Leaving Maui the next place inspected was Hawaii, taking the different districts as follows: North and South Kohala, Kona, Kau, Puna and Hilo. Three weeks were spent on Hawaii. The Island of Molokai was next visited, the greater part of which was gone over. Mr. Griffith then inspected the forests on Oahu.

The people met with in the different districts of the Islands visited, gave their views and information as far as they could, and lent every assistance.

As has been mentioned in former reports, and also in Mr. Griffith's report, the fencing of forest lands under government control, not suitable for agricultural purposes, is one of the first steps, which ought to be taken in forestry work. It is, therefore, important to ascertain the amount of land to be fenced, and the amount of fencing required for each district; also an estimate of the amount of money required to be laid before the Legislature at their next session. The lands to be planted and an estimate of the amount of money required for such, ought to be drawn up also.

The forestry work done in Nuuanu, during the period mentioned, has been principally the raising and planting out of forest trees and as might be expected much of the

work is still experimental. The suitability of many of the species is being tried, as the different sylvicultural treatments, which they require under the conditions to be met with, are question which can only be satisfactorily settled by experience. Various varieties of trees indigenous to many different countries, are being tried, also a number of trees indigenous to the Hawaiian Islands.

This tract of land is situated at the top of Nuuanu Valley, and is exposed to the full force of the wind, which blows through the gap between the two mountains with terrific force, at times, and many of the trees that do well in more sheltered parts of the Islands, fail to do so here.

Trees to the number of 30,000 have been planted out during the period, consisting of the following species exotic:

Acacia Melanoxylon.
Casuarina Equistifolia.
Cupressus Macrocarpa.
Eucalyptus Robusta.
Grevillea Robusta.

Numerous other species have been experimented with, and given a fair trial, but none of them have showed any signs of equaling the above named kinds as to rate of growth, resistance to wind, etc. The indigenous species being tried, do not seem to stand the wind so well as the exotic trees mentioned. However, the trees have not had time yet to get a fair start, and a more complete report of their resistance to wind, rate of growth, etc., will have to be given later.

The following species at the station in seed boxes and leaf pots are as follows: Uhiuhi, lama, halapepe, ohe and opiko. Other native species have been tried, some of them after sprouting have perished owing to the heavy

rains. A propagating house with a glass or canvas roof is greatly needed for tender seedlings. Plants of a robust nature stand the rains fairly well.

A patch of Panicum spectabile grass raised from seeds at the Government Nursery, and planted here about two years ago, is doing splendidly. This patch is the source of supply for the many applicants from all over the islands.

Other work done at the station has been an addition to the laborer's quarters to accommodate three extra men, which brings the number now employed to eight. A kitchen has been built to the forester's cottage, also a three inch wooden flume laid to carry water from the stream to a small reservoir. Connected with it is a one and a half inch iron pipe running to quarters and cottage, which gives an ample supply of water. This work was done to take the place of an old pump which was always getting out of order. The road leading from the station to the main one, which is part of the old Pali road has been repaired, and three wooden bridges built to take the place of old ones, which were getting dangerous. This part of the road has been going from bad to worse since the new road was built, and the work was deemed necessary, this being the only approach to the station from the main road.

Considerable work has been done in rooting out lantana, which is sprouting up all over the tract and much is still to be done, so that the land may be kept clear for planting before the lantana gets too big a hold. Once the land is covered with lantana, it is extremely difficult and also expensive to reforest the same.

Respectfully submitted,

DAVID HAUGHS,
Forester.

REPORT OF PROF. KOEBELE ON LANTANA SCALE.

HONOLULU, August 29, 1901.

MR. WRAY TAYLOR,

Commissioner of Agriculture and Forestry.

SIR:—

I herewith submit notes on the Lantana Scale, ORTHEZIA INSIGNIS, Douglas, affecting those plants on the Island of Maui.

PAST HISTORY.

Mr. E. E. Green, the present Government Entomologist of Ceylon gives us the first record of the habit of this insect in "Tropical Agriculturist, January, 1895." I have in my possession a reprint of this paper entitled "An Important Insect Enemy and the Need for Planters to Guard Against Its Spread." I quote from this paper the following:

"In Dr. Trimen's Annual Report on the Botanical Gardens for 1893, mention was made of the occurrence in the Peradeniya Gardens of a serious insect-pest which was most destructive to the ornamental shrubs there. As this pest has been increasing very rapidly and has already spread beyond the limits of the gardens, it is important that general attention should be drawn to it.

Within the Peradeniya Gardens efforts are being made to keep it in check; but it has appeared on lantana in the neighborhood, and there is no knowing where it will stop. It has fortunately as yet shown no taste for either of our two most important products—tea and cacao. Coffee, however, does not share this immunity, for trees of

Liberian coffee have been observed to be infested with the insect, and we have no reason to suppose that the Arabian species will be less liable to attack.

Dr. Trimen is of the opinion that this is mainly a garden pest, and does not expect that it will spread to estates. It is to be hoped that this prediction will prove correct; but it would be unwise to ignore the fact that, if unchecked, the pest might spread enormously and might possibly develop a taste for other plants; as was the case with the Fluted Scale (ICERYA PURCHASI) which, at first practically confined to acacia and orange trees, finally became almost omnivorous. "Forewarned is forearmed;" and, though it would be most imprudent to create a scare, it is still most advisable to point out a possible danger.

As mentioned above, the insect has obtained a foothold upon lantana. Should it once become widely and firmly established, it will be extremely difficult to deal with, and wherever lantana flourishes there will be a stronghold of the pest. Though most accommodating in its tastes this bug at present shows a preference for plants belonging to the natural orders Acanthaceae, Rubiaceae (which includes coffee and cinchona), and Verbenaceae, (of which lantana is a member). To the first of these orders belong our numerous species Nelu (STROBILANTHES), which might form another possible breeding-ground as extensive and even more impregnable than the lantana scrub."

As a remedy to eradicate the pest, Mr. Green has this to say:

"Determined efforts should be made to stamp out the pest upon its first appearance in any locality. Infected plants should be treated on the spot, regardless of expense and, if necessary, with complete sacrifice of the plant. Too great stress cannot be laid upon the impor-

tance of "Treatment upon the spot" in all cases of serious insect-pests. The pruning of affected plants and subsequent carriage of the cuttings to some spot where they might be burnt or buried would only serve to sow the pest broadcast along the route of transport. However, much a fixture the adult insect may seem to be, as in the case of many of the scalebugs, it must be remembered that the young are very minute, very active, and usually very numerous.

Should a colony of the insects be discovered upon any plant, a good-sized hole might be dug beside it, in which a fire of dry brush-wood and grass could be lighted. The plant should then be cut down or pruned to bare poles, the pruning thrown directly on to the fire, and all dead leaves and rubbish from below the plant swept into the hole. The hole should afterwards be filled with earth to prevent the escape of any possible survivors.

In places where the pest has established itself on lantana or other waste land, such patches should be fired.

On cultivated land such extreme measures will usually be impracticable. In this case repeated and thorough spraying with insecticides will be the only available course. For the purpose kerosene-soap emulsion would probably be the most effective and economical. It should be very carefully and thoroughly applied, and should be repeated at short intervals until the pest has been exterminated. Where practicable it would be advisable to first prune the trees (burning and burying the prunings as suggested above), and then to spray the remaining stems and branches.

The formula for kerosene emulsion is—

Kerosene .....2 gallons.
Common soap .....½ lb.
Water .....1 gallon.

Dissolve the soap in water heated to boiling. Add the kerosene to the hot mixture, and churn till it forms a thick cream on cooling. Dilute with from 9 to 12 times water for application.

As far as known to me the insect is still present in Ceylon and also in India, and it will always be a troublesome pest until the proper natural enemy can be found."

In an article on "The Eradication of LANTANA SCANDENS" in The Indian Forester, Vol. XXVII, No. 1, pp. 29, 30, the writer mentions in addition, cinchona, belonging to the RUBIACEAE; the red pepper and tomato of the large order of SOLANACEAE. The article is of interest and we give it herewith.

The other enemy is fortunately, not yet very well known in India.

This enemy is a scalebug, ORTHEZIA INSIGNIS, originally discovered at Kew, where it was causing damage in the plant houses. It was noticed in Ceylon in 1893, or thereabouts, and was supposed to have been introduced from Kew, because it was first observed in the Royal Gardens, at Peradeniya, to which place plants are often sent from Kew. But this is not clear to me, because the pest is also known and gives trouble in Natal. It was first noticed on LANTANA in June, 1898. By August, 1898, it had spread with alarming rapidity.

This ORTHEZIA is one of the most destructive scalebugs known, and confines its attention to LANTANA, and is equally destructive to many other species. When it is known that these species includes tea, coffee, both Arabian and Liberian, cinchona and the tomato, it will be seen that the appearance of the pest, on lantana, was viewed in Ceylon. The government and planting community there were justified in immediately taking the most drastic steps to stamp it out.

ITS APPEARANCE ON THE HAWAIIAN ISLANDS.

During November, 1899, Mr. G. P. Wilder found the insect at Wailuku, Maui. Specimens of the insect were forwarded to me at Sydney, N. S. W., by Mr. David Haughs, with letter dated November 24, 1899. Mr. Haughs wrote, "I send you, by same mail, sample of scale found by Mr. G. P. Wilder, preying on the lantana on Maui. He thinks that he has got the lantana destroyer for sure. It is the scale with a white body and black head. He wants to know all about it for he claims it is killing the lantana on Maui. We were looking up your case of scale-bugs but could not find it. He is very anxious to hear from you on the subject, and asked if I would send you a sample." I immediately recognized the Lantana Scale, ORTHEZIA INSIGNIS, and accordingly requested Mr. Wilder to have the patches of lantana with the destructive scale insect burned, informing him fully of the danger of this pest. This letter had been acknowledged under date of January 12, 1900. During the summer of the same year, Mr. Wilder personally informed me that he had the lantana and scalebugs burned.

On my visit to Maui, I have been informed by Brother Frank of the Catholic Mission, that he first found the insect near a Japanese store, and brought the same to a patch of lantana near a river where Mr. Wilder had found it a few months later.

In a recent article in the Maui News, attention is again called to the Lantana Blight, as being an effective enemy to that plant, and we learn that the insect had been distributed over a large area.

While over on Kauai I was repeatedly asked to give advice as to whether the insect could be introduced there with any prospect of destroying the lantana plant. In

every instance the parties were given to understand, that by so doing, they may even see a more dangerous pest than the plant in question.

THE HABIT OF THE INSECT.

The first indication noticeable of the presence of the ORTHEZIA upon lantana is a decided black and smoothly appearance of the plants affected. As is the case with many other Cocids, this is the result of the honey-dew exuded by them, which adheres to the foliage and twigs and a black fungoid grows upon the same. An ALEURODES found upon lantana in the Kona district produces the same effect. Owing to the black appearance of the infested plants the lantana blight can be seen a long distance off.

On closer examination the ORTHEZIA can be seen in enormous numbers attached to the underside of leaves, the twigs and branches of plants. To the naked eye the general effect is a mass of dirty-white insects. The body of the insect is of a dark brownish or olive-green. It has three pairs of well developed legs, and its beak is situated between the front pair. There is a row of short white conical processes along the middle of the back, and a fringe of similar but stouter appendages round the margin, gradually increasing in length towards the hinder part of the insect. From below the posterior extremity of the body proceeds a stout white cylindrical appendage, fluted above, smooth below, varying in length according to the age of the insect, reaching in some individuals to nearly four times the length of the body, broad at base, and very gradually tapering to extremity which is slightly upcurved. This is the ovisac, and contains a vast number of eggs that remain until they have hatched when they make their exit through an aperture, at its

extremity. If one of these egg-cases be broken open, it will generally be found to be filled with eggs and young insects. The eggs at the base of the tube are of a very pale creamy color, having been just laid; while lower down they become bright yellow, orange, and then greenish, and the young insects ready to emerge from the tube are olive green. A wooly secretion fills up the crevices between the eggs. These white appendages are very fragile and easily broken. I found the mature male insects were bred from cocoons found in large numbers under stones amongst leaves and rubbish on the ground at the Peradeniya Gardens, on my first visit to that place. Mr. Green has described the same as follows: "It is a delicate little fly; slaty gray in color; antennae very long and slender; 10-joined, the two basal joints very short, the others greatly elongated; legs long and slender; a single pair of wings, rather opaque, dusted with grayish powder; tuft of long silky filaments at the end of body. Eyes black with numerous facets. The adult male insect has no mouth, and consequently takes no food in this stage."

It is evident that the insect has appeared on Maui some two years since, and up to date has paid its attentions only to the lantana plant. In no instance has it been observed by me to appear upon any of its many known food plants, and as far as I could learn, no one has, as yet, observed the same outside of the lantana.

PLANTS LIKELY TO BE ATTACKED BY THE INSECT.

As Mr. Green informs us, these are of the order of ACANTHACEAE, RUBIACEAE and VERBENACEAE. From India we learn that TERNSTROEMIACEAE is included to which be-

long the CAMELLIA, the common tea-plant, and also the SOLANACEAE.

Amongst the RUBIACEAE the Hawaiian flora is very rich, chiefly in shrubs and trees, some of these important forest plants. Hillebrand records sixteen species of Kadua, shrubs of various sizes in our forests. Five species of GOULDIA, shrubs and small trees. Two species of GARDENIA, several of these are in cultivation. BOBEA, five species of forest trees. PLECTRONIA, a shrub. COFFEE, both the Arabian and Liberian coffee trees. MORINDA, two species, a third recently introduced from Fiji. STRAUSSIA, five species of important forest trees. PSYCHOTRIA two trees. PAEDERIA FOETIDA, this is the tall woody climber overrunning trees and shrubs in the mountains near Honolulu. NERTERA, one species. COPROSMA, nine species of shrubs and small trees.

In cultivation we have many ornamental plants of this order, as those handsome shrubs, the IXORA, PAVETTA, BOUWARDIA, MUSAENDA, PENDAS CARNEA, SERISSA FOETIDA and others.

Under the VERBENACEAE come a large number of troublesome weeds, such as VERBENA BONARIENSIS, V. OFFICINALIS, PRIVA ASPERA, STACHYTARPHETA DICHOTOMA, LANTANA CAMARA. VITEX TRIFOLIA, (growing so abundantly on the sand hills in Maui, belongs here. As yet, the blight could not be found upon the same) and the various species of CLERODENDRON, of these C. FRAGRANS has spread up in all the valleys near Honolulu.

To the order of TERNSTROEMIACEAE belongs the tea-plant; Camellia, and a small tree spread all over the islands, this is EURYA SANDWICENSIS.

The tomato, LYCAPERSICUM ESCULENTUM, and the red pepper, various species of CAPSICUM are mentioned as food plants of the lantana blight. These are included in the

large order of SOLANACEAE to which belongs the potato and egg-plant in several varieties. Of SOLANUM we have some ten species of shrubs and trees growing on the Islands. NOTHOCESTRUM is represented in four species of forest trees. LYCIUM SANDWICENSE furnishes us with a fruit. RHYSALIS PERUVIANA is the common Cape-Gooseberry.

NICANDRA PHYSALOIDES, DATURA STRAMONIUM, a very common weed. The FLORIPONDIO. The NICTIANA GLAUCA and N. TABACUM, are all liable to be attacked. Beside these quite a lot of ornamental garden plants belong to this order.

OTHER SPECIES OF ORTHEZIA KNOWN TO ME AND ENEMIES FOUND UPON THE SAME.

So far, sixteen species of ORTHEZIA are recorded and some of these will prove synonymous. In my travels and study of the COCCIDAE and their enemies, I have had no occasion to search for enemies of this blight, as none were present upon our island previous to the appearance of O. INSIGNIS.

During 1891, several specimens of these scales were found on SLIDAGO, in Oregon. No enemies observed. This is likely O. AMERICANA of Canada and the United States. A very large and handsome form was found on roots at Yucca, at Taluca, Mexico, August 1-2, 1897, and later on roots of various other shrubs and plants. No enemies observed. About the same time, at the foot of Popocatepetl, Mexico, a small ORTHEZIA was found to infest a species of BACCHARIS, the insects being very abundant especially in its early stage. As far as I can remember, this is not unlike our species. I found no parasites in box on mounting them November, 1897. At Oaxaca, Mexico, August 20, 1897, upon garden plants unknown to me, an ORTHEZIA was found numerous. Specimens

saved in pill boxes had produced no parasites on November 25, 1897, but four pupae of a Scymnid (Hyperaspis) were found present and dead.

During the latter part of June, 1895, at Nikko, Japan, upon a species of ARTEMISIA, an ORTHEZIA was found, which was somewhat larger than our species. A few specimens were saved in pill boxes. From these scales a species of HYPERASPIS was bred, and according to Mr. Schwarz, it proved to be new to Japan where but one species had been recorded, viz: H. JAPONICA. The beetles had developed within the egg-sacks of the scale. It is closely related, if not the same, to the European H. REPPENSIS.

ENEMIES OF THE INSECT.

Aside from the small ladybirds (HYPERASPIS) above mentioned, no parasites are known to me as preying upon this peculiar scale-insect. While in Ceylon during the beginning of 1895, I expressed myself as to the possibility of CRYPTOLAEMUS MONTROUZIERI feeding upon this blight, and Mr. Green has made an attempt of introducing the same. The insect has now been observed amongst, and close to, the ORTHEZIA upon lantana, yet to all appearances it is seen to be feeding upon mealy-bugs DACTYLOPIUS). It is still likely that in time this voracious friend of ours may acquire a taste for the same. At the present we only know of the HYPERASPIS, the habits of quite a number have been studied, and most of them were sent here; unfortunately we have never met with any on these islands.

I will herewith give a few short notes of these interesting beetles. Out of the one hundred and seventy-five known species, the greatest number are known to occur in South America.

Some six species were sent here from California, and as

far as could be seen these all feed, more or less, upon DACTYLOPIUS.

HYPERASPIS JAPONICUS, Crotch; H. ASIATICA, Lewis; CRYPTOGONUS TESTACEICORNIS, Weise; the only Japanese species recorded. Always found upon orange. To all appearances it is feeding upon DACTYLOPIUS. Its larvae were also found very numerous upon eggs of various Pulvinaria, and repeatedly has been bred from egg-masses of various DACTYLOPIUS. Sent here in large quantities.

HYPERASPIS, sp. n. Bred from a peculiar coccid upon CALLICARPA TOMENTOSA, at Hong Kong, China, October, 1895. The coccid has been named by Mr. Maskell, as MALLOPHORA SINENSIS. Mask. (New gen, et. sp.)

HYPERASPIS PAZOSAE, Gorham feeding upon a peculiar Dactylopid common upon various trees in parks, City of Mexico.

HYPERASPIS Sp. Common upon Dactylopius, City of Mexico. Also bred upon D. CERIFERUS at Cuantla, Morelos, Mexico, November, 1897. Also bred from INGLISIA, Sp. upon MALVA at Cuantla.

HYPERASPIS PICTUS, Gorham. H. FLAVIFRONS, Mels. upon DACTYLOPIUS CERIFERUS on Ash. Cuantla Morelos, also collected at Hennosillo and Guaymas, Sonora, April, 1897.

HYPERASPIS CENTRALIS, Muls, was found at Cordoba, Mex.

HYPERASPIS LATERALIS, Muls. A common California form upon DACTYLOPIUS, also found at El Paso, Texas, May 10, 1897, upon LARREA MEXICANA, infested with PULVINARIA. Very numerous upon Dactylopid in parks, City of Mexico.

HYPERASPIS JACOSA, Muls. Found at Oaxaca, Mexico, August 20, 1897, upon no particular scale insect.

HYPERASPIS ANNEXA, Lec. (Var) at Cuantla, Morelos, Mexico, August, 1897. One of the most numerous ene-

mies to the Cochineal insect upon which these ladybirds were bred. Also present in the United States.

HYPERASPIS OSCULANS, Lec. and H. FIMBRIOLATA, Melsh. were found upon LARREA MEXICANA, infested with DACTYLOPIUS and PULVINARIA, at El Paso, Texas, May, 1897.

Aside from the above a number of unnamed species were collected in the State of Sonora, Mexico. Nearly all of the species mentioned were sent here.

CONCLUDING REMARKS.

It is a well known fact, both in Ceylon and India, that the ORTHEZIA INSIGNIS, is a pest more feared than the lantana itself. It has no enemies, and consequently will increase to enormous numbers, overrunning the whole country and destroying plants other than lantana.

The ORTHEZIA INSIGNIS has been present in Ceylon for nine years, and has proven itself useless in eradicating the lantana.

Lantana is still growing in places where ORTHEZIA had been placed two years since.

It may prove a serious menace to our already fast disappearing forest trees. It is highly advisable that the insect should be kept to the island of Maui as long as possible. At its appearance on the other islands the affected plants and surroundings, for a few years, should be burned to keep it from spreading. A watch should be kept on such places for the next six months.

We do not take the invasion as a very serious apprehension, but feel undaunted in being able to overcome all consequences if occasion should require it.

Respectfully submitted,

A. KOEBELE,
Entomologist.

REPORT

OF THE

Commissioner of Agriculture and Forestry.

HONOLULU, December 31st, 1902.

HIS EX. SANFORD B. DOLE,

Governor Territory of Hawaii.

DEAR SIR:—

I have the honor to submit the following report of the Commissioner of Agriculture and Forestry for the six months ending December 31st, 1902:

GOVERNMENT NURSERY.

The demand on the Government Nursery for plants, etc. has been unusually large during the period, the largest ever known in the history of the Nursery. The report of the Gardener, which is attached, shows the following distribution:

Palms	4,519	
Shade trees, Shrubs and Vines	11,799	
Fruit Trees	2,716	
Forest trees	14,382	
Total		33,416

Distribution by Islands as follows:

Oahu	22,266	
Hawaii	4,103	
Maui	521	
Molokai	2 020	
Kauai	4,506	
Total		33,416

NUUANU FOREST.

The work of foresting here is progressing rapidly under the care of the Forester whose report is attached. Just before the period closed, we had a visit from Mr. Gifford Pinchot, head of the Forestry Department at Washington, who was returning from a trip to the Philippines. Mr. Pin'chot was shown both the Nuuanu and Tantalus forests and expressed himself as much pleased with their appearance. He intends to make a long visit in the summer of 1903.

COMPETITIVE EXHIBITION OF PLANTS, FRUITS, ETC.

It gives me much pleasure to report that the competitive exhibition of plants, fruits, etc. held in the drill shed Honolulu, July 28th and 29th, was a decided success, and attracted a large number of visitors. I quote the following from one of the local papers regarding the exhibition: "The display made by the growers of fruit, vegetables, flowers, etc. called forth the encomiums of all who saw it. Collected together, the products of the gardens and small plantations are very satisfactory indeed, and show what is being done in the line of horticultural cultivation. Some of these products have been grown purely for home use and not for sale, but it is satisfactory to see

that some of the products are really in the line of minor industries and are raised for profit. The good done by the exhibition is very great. It arouses emulation and it shows what can be done."

Another paper says: "The Agricultural Fair has been voted a distinct success by all the visitors. The exhibitors join in commendation of the arrangements, and there have been no hitches on space or accommodations. The Commissioner promises an enlargement on the Fair next year, now that the first has proved a decided success."

In order to carry out an exhibition on a more extensive scale, I have asked for a large appropriation for the coming period. This would make it more of an Agricultural Fair giving wider scope. The Hawaiian Graziers Association brought the matter up at their annual meeting and there should be hearty co-operation all along the line. The prize list at the July exhibition was as follows:

PRIZE LIST COMPETITIVE EXHIBIT JULY 28TH, 29TH.

DIVISION I.

Mangoes—1st, Geo. R. Carter; 2d, Rev. H. Isenberg.

Alligator Pears—1st, Mrs. Doherty Sylva; 2d, Mrs. Doherty Sylva.

Pineapples—1st, Hawaiian Fruit & Plant Co.; 2d, T. S. Holloway.

Figs—1st, Mrs. S. C. Allen; 2d, Donald McIntyre.

Watermelons—1st, E. H. Bailey; 2d, J. Cullen.

Oranges—1st, Lahainaluna Seminary.

Lemons—1st, Eben P. Low.

Papaias—1st, George Lishman; 2d, S. G. Wilder.

Grapes—1st, Donald McIntyre; 2d, Mrs. Woolsey.

Peaches—1st, G. P. Wilder.

Pohas--1st, William Apela.

Mountain Apples--1st, S. L. Kaleikau.

Bananas, best bunch--1st, Donald McIntyre; 2d, Mrs. K. Brenig.

Bananas, best hand—1st, Miss Lucy Kaleikau; 2d, Miss Lucy Kaleikau.

Cocoanuts—1st, Lahainaluna Seminary; 2d, Lahainaluna Seminary.

Best exhibit of fruits—1st, Lahainaluna Seminary; 2d, Buchholtz Plantation.

DIVISION II.

Potatoes, Irish—1st, J. B. Wilson, Makawao; 2d, W. R. Castle.

Potatoes, sweet—1st, Puuhue Ranch; 2d, Lahainaluna Seminary..

Cabbage—1st, Buchholtz Plantation.

Sweet Corn—1st, Kamehameha Agri. Dept.

Field Corn—1st, E. H. Bailey.

Beans, shell—1st, Kamehameha Agri. Dept.; 2d, Buchholtz Plantation.

Beans, string—1st, Kamehameha Agri. Dept.; 2d, Kamehameha Agri. Dept.

Beets—1st, Kamehameha Agri. Dept.

Tomatoes—1st, Lahainaluna Seminary; 2d, E. W. Thwing.

Carrots—1st, J. Lindsay, Haiku; 2d, J. Lindsay, Haiku.

Lettuce—1st, Kamehameha Agri. Dept.

Chilipepers—1st, G. P. Wilder; 2d, Mrs. Woolsey.

Dry land taro—1st, W. C. Achi; 2d, Buchholtz Plantation.

Pumpkins—1st, Kamehameha Agri. Dept.; 2d, E. H. Bailey.

Squash—1st, E. W. Thwing; 2d, Kamehameha Agri. Dept.

Best exhibit of vegetables—1st, Buchholtz Plantation; 2d, Lahainaluna Seminary.

Special diploma for exhibit of vegetables, awarded to Kamehameha Agri. Dept.

DIVISION III.

Coffee exhibit—1st, Louisson Bros.; 2d, Louisson Bros.

DIVISION IV.

Sorghum—1st, D. P. R. Isenberg; 2d, J. Cullen.

Guines grass—1st, G. R. Carter; 2d, D. P. R. Isenberg.

Buffalo grass—1st, Buchholtz Plantation.

Alfalfa—1st, D. P. R. Isenberg; 2d, J. Cullen.

Panicum grass—1st, W. B. Thomas; 2d, Ahuimanu Ranch.

DIVISION V.

Potted Palms—1st, Donald McIntyre; 2d, Donald McIntyre.

Hawaiian Loulu palm—1st Donald McIntyre; 2d, Mrs. Ethel M. Taylor.

Collection of ferns—1st, Mrs. Ethel M. Taylor; 2d, Donald McIntyre.

DIVISION VI.

Cut flowers—1st, T. C. McGuire; 2d, Kawaihau Florist.

Roses—1st, Donald McIntyre; 2d, Kawaihau Florist.

Carnations—1st, Kawaihau Florist; 2d, Mrs. Woolsey.

Asters—1st, T. C. McGuire; 2d, T. C. McGuire.

Orchids—1st, Donald McIntyre; 2d, Donald McIntyre.

DIVISION VII.

Ilima leis—1st, Kawaihau Florist; 2d, Mrs. Woolsey.

Carnation leis—1st, Kawaihau Florist; 2d, Kawaihau Florist.

Maile leis—1st, Kawaihau Florist; 2d, Kawaihau Florist.

Plumaria leis—1st Kawaihau Florist; 2d, Mrs. Mary K. Tibbetts.

Special diploma awarded Donald McIntyre for display of Caladiums.

THE FIBER INDUSTRY.

The planting of sisal is going on in an encouraging manner and this industry stands next to the staple one. Mr. F. W. Beckley has now fifteen thousand plants of the Agave Sisalana set out on his land in the Island of Molokai. The Kona Agricultural Co. at Hookena have planted twenty thousand, and a number of plants have also been put out by the Pioneer Mill Co. of Lahaina. At Sisal there is great activity, the Hawaiian Fiber Co., Ltd., having their fiber machine in running order. At the end of December they made their first shipment of fiber to the Coast, consisting of 50 bales of as good fiber as any one need wish to see. The bales weighed from five hundred to five hundred and fifty pounds. I spent a day at Sisal soon after the installment of the machinery, and Manager Turner is to be congratulated on the success of the enterprise. At the time this shipment of fiber was made the market price was 8½ cents per pound.

THE ENTOMOLOGISTS.

Prof. R. C. L. Perkins has been hard at work during the period receiving and taking care of the packages of beneficial insects, etc. sent by Prof. Koebele from Mexico. He has also examined all plants, etc. for foreign countries. Prof. Koebele is still in Mexico as the period closes. His report on the lantana scale will be a special one and will be made upon his return. In his letters he speaks of the ultimate success of his undertaking. It will be

very necessary to have two entomologists, one remaining in Honolulu, the other traveling in search of beneficial insects, etc., half of his time working for the planters Association as heretofore.

VANILA CULTURE.

Mr. E. H. Edwards, who has had considerable experience in the cultivation of the vanila bean in different countries, has established himself at Napoopoo, Hawaii. He recently made a trip to Fiji returning with ninety-three cases of vanila cuttings. He writes he has planted out seven thousand, and feels certain of success.

DISTRIBUTION OF SEEDS.

The supply of different vegetable seeds is not exhausted; any one can be supplied by calling at the office. Many palm seeds and also seeds of shade and ornamental trees have been distributed, some going abroad.

PLANT DISEASES AND INSECT PESTS.

One of the most important matters I have to call your attention to, is the passing of a law for the protection of horticulture, and to prevent the introduction into the Territory of insects, or diseases, injurious to fruit or forest trees, sugar canes, vegetables, etc. All plants coming from a foreign country, we have a right to inspect, and I must say that this work has been excellently performed by Prof. Perkins, who is extremely careful in his examination. In one shipment of cocoanuts from Samoa he found thirty-two insects he had not seen in Hawaii. They were destroyed, as was also a shipment of infected sugar cane, and plants from Japan, the soil containing larvae.

Plants coming from domestic ports, San Francisco, Seattle, San Diego, Portland, etc., we cannot examine

only by the courtesy of their owners. There is direct steamer communication with Hilo and Kahului. I would suggest that planter inspectors be appointed at Hilo and Mahukona, Island of Hawaii, and Kahului, Island of Maui. The matter is of the utmost importance affecting as it does the agricultural interests of the Territory. Strong measures must be adopted to keep out these pests and blights and I herewith present an Act which is similar to one in force in California for your consideration, to be placed before the Legislature at the coming session.

AN ACT FOR THE PROTECTION OF HORTICULTURE, AND TO PROTECT THE INTRODUCTION INTO THE TERRITORY OF HAWAII OF INSECTS, OR DISEASES, INJURIOUS TO FRUIT OR FRUIT TREES, SUGAR CANES, VINES, BUSHES OR VEGETABLES, AND TO PROVIDE FOR A QUARANTINE FOR THE ENFORCEMENT OF THIS ACT.

Be it Enacted by the Senate and House of Representatives of the Territory of Hawaii:

Section 1. Any person, persons or corporation who shall receive, bring or cause to be brought into this Territory from any domestic or foreign ports, any nursery stock, trees, sugar canes, shrubs, plants, vines, cuttings, grafts, cions, buds, or fruit pits, or fruit or vegetables, shall within twenty-four hours after the arrival thereof, notify the Commissioner of Agriculture and Forestry, of their arrival, and hold the same without unnecessarily moving the same, or placing such articles where they may be harmful, for the immediate inspection of the Commissioner of Agriculture and Forestry. The Commissioner or such person, or persons as shall be commissioned by him to make such inspection, are hereby authorized and empowered to enter into any warehouse, depot,

or upon any dock, wharf or any other place, where such nursery stock, or fruit, or vegetables, or other described articles are received, for the purpose of making the investigation or examination herein provided for.

Section 2. Each case, box, package, crate, bale or bundle of trees, sugar canes, shrubs, plants, vines, cuttings, grafts, cions, buds or fruit pits, or fruit or vegetables, imported or brought into this Territory, shall have plainly and legibly marked thereon in a conspicuous manner and place the name and address of the shipper, owner, or person forwarding or shipping the same, and also the name of the person, firm or corporation to whom the same is forwarded or shipped, or his or its responsible agent, also the name of the Country, State or Territory where the contents were grown.

Section 3. When any shipment of trees, sugar canes, shrubs, plants, vines, cuttings, grafts, cions, buds, fruit pits, or fruit or vegetables, imported or brought into this Territory, is found infected with injurious insects, or their eggs, larvae, or pupae, or infected with tree, plant or fruit disease or diseases, the entire shipment shall be disinfected at the expense of the owner, owners or agent. After such disinfection, it shall be detained in quarantine the necessary time to determine the result of such disinfection. If the disinfection has been so performed as to destroy all insects, or their eggs, and so as to eradicate all disease and prevent contagion, and in a manner satisfactory to the Commissioner of Agriculture and Forestry, or the persons commissioned by said Commissioner, the trees, sugar canes, vines, vegetables, seeds, or other articles shall then be released.

Section 4. When any shipment of trees, sugar canes, shrubs, plants, vines, cuttings, grafts, cions, buds, fruit pits, or fruit or vegetables, imported or brought into the Territory from domestic or foreign ports, is found infect-

ed with any species of injurious insects, or their eggs, larvae, or pupae, not existing in the Territory, such infected shipments shall be immediately destroyed at the expense of the owner, owners or agent.

Section 5. Any person, persons, or corporation violating any of the provisions of this Act is guilty of a misdemeanor.

Section 6. This Act shall take effect and be in force from and after the date of its passage.

Respectfully submitted,

WRAY TAYLOR,

Commissioner of Agriculture and Forestry.

———:o:———

REPORT OF THE GARDENER AT THE GOVERNMENT NURSERY, FOR THE SIX MONTHS ENDING DECEMBER 31ST, 1902.

MR. WRAY TAYLOR,

Commissioner of Agriculture and Forestry.

SIR:—

Herewith I submit my report of the distribution of plants, trees, etc. from the Government Nursery for the six months ending December 31st, 1902.

ISLAND OF OAHU.

July, 1902.

Palms	428	
Shade trees, Shrubs and Vines	818	
Fruit trees	344	
Total		1,590

August, 1902.

Palms	436	
Shade trees, Shrubs and Vines	515	
Fruit trees	191	
Total		1,142

September, 1902.

Palms	1,485	
Shade trees, Shrubs and Vines	3,164	
Fruit trees	833	
Forest trees	6,252	
Total		11,734

October, 1902.

Palms	509	
Shade trees, Shrubs and Vines	3,644	
Fruit trees	385	
Total		4,538

November, 1902.

Palms	323	
Shade trees, Shrubs and Vines	811	
Fruit trees	141	
Total		1,275

December, 1902.

Palms	188	
Shade trees, Shrubs and Vines	181	
Fruit trees	158	
Forest trees	1,460	
Total		1,987

GRAND TOTAL FOR THE ISLAND OF OAHU.

Palms	3,369	
Shade trees, Shrubs and Vines	9,133	
Fruit trees	2,052	
Forest trees	7,712	
Total		22,266

ISLAND OF HAWAII.

July, 1902.

Palms	18	
Shade trees, Shrubs and Vines	1	
Fruit trees	50	
Total		69

August, 1902.

Palms	316	
Shade trees, Shrubs and Vines	279	
Fruit trees	316	
Total		911

September, 1902.

Palms	20	
Shade trees, Shrubs and Vines	34	
Fruit trees	24	
Forest trees	500	
Total		578

October, 1902.

Palms	12	
Shade trees, Shrubs and Vines	70	
Total		82

November, 1902.

Palms	46	
Shade trees, Shrubs and Vines	2	
Fruit trees	18	
Forest trees	1,190	
Total		1,256

December, 1902.

Shade trees, Shrubs and Vines	28	
Fruit trees	45	
Forest trees	1,134	
Total		1,207

GRAND TOTAL FOR THE ISLAND OF HAWAII.

Palms	412	
Shade trees, Shrubs and Vines	414	
Fruit trees	453	
Forest trees	2,824	
Total		4,103

ISLAND OF MAUI.

July, 1902.

Palms	12	
Fruit trees	18	
Total		30

August, 1902.

Palms	6	
Shade trees, Shrubs and Vines	20	
Fruit trees	2	
Total		28

September, 1902.

Palms	35	
Shade trees, Shrubs and Vines	27	
Fruit trees	64	
Total		126

October, 1902.

Palms	29	
Shade trees, Shrubs and Vines	104	
Fruit trees	24	
Total		157

November, 1902.

Shade trees, Shrubs and Vines	18	
Fruit trees	36	
Total		54

December, 1902.

Shade trees, Shrubs and Vines	98	
Fruit trees	28	
Total		126

GRAND TOTAL FOR THE ISLAND OF MAUI.

Palms	82	
Shade trees, Shrubs and Vines	267	
Fruit trees	172	
Total		521

ISLAND OF MOLOKAI.

October, 1902.

Palms	568	
Shade trees, Shrubs and Vines	1,416	
Total		1,984

December, 1902.

Palms	14	
Fruit trees	22	
Total		36

GRAND TOTAL FOR THE ISLAND OF MOLOKAI.

Palms	582	
Shade trees, Shrubs and Vines	1,416	
Fruit trees	22	
Total		2,020

ISLAND OF KAUAI.

August, 1902.

Shade trees, Shrubs and Vines	63	
Fruit trees	9	
Forest trees	2,494	
Total		2,566

September, 1902.

Palms	36	
Total		36

October, 1902.

Palms	15	
Shade trees, Shrubs and Vines	468	
Forest trees	164	
Total		647

November, 1902.

Forest trees	588	
Total		588

December, 1902.

Palms	23	
Shade trees, Shrubs and Vines	38	
Fruit trees	8	
Forest trees	600	
Total		669

GRAND TOTAL FOR THE ISLAND OF KAUAI.

Palms	74	
Shade trees, Shrubs and Vines	569	
Fruit trees	17	
Forest trees	3,846	
Total		4,506

TOTAL NUMBER OF PLANTS DISTRIBUTED DURING THE SIX MONTHS ENDING DECEMBER 31ST, 1902.

Palms	4,519	
Shade trees, Shrubs and Vines	11,799	
Fruit trees	2,716	
Forest trees	14,382	
Total		33,416

Respectfully submitted,

C. J. AUSTIN,
Gardener.

———:o:———

REPORT OF THE FORESTER NUUANU FOR SIX MONTHS ENDING DECEMBER 31ST, 1902.

HONOLULU, December 31st, 1902.

MR. WRAY TAYLOR,
Commissioner of Agriculture and Forestry.

SIR:—

The forestry work that is being done in Nuuanu is similar to the work done on Tantalus and is principally prac-

tical work in propagating and tree planting. During the past ten years both on Tantalus and Nuuanu, much experiment work has been going on with exotic tree seeds from many different countries. The experience gained will be valuable in planting up new areas and will save time in discarding many kinds that have been found to be unsuitable for this country. At the top of Nuuanu Valley where we are now planting, great difficulty has been experienced in getting suitable trees to stand the winds. The ironwood which is considered one of the best breakwind trees in existence, often get destroyed here. We have had several severe gales during the period and the planted part had to be gone over several times, and trees planted where others had been killed. As mentioned in former reports, the four best kinds yet tried are the Acacia Melanoxylon, Casuarina Equistifolia, Eucalyptus Robusta and Grevillea Robusta. Experiments have also been made with a number of indigenous trees including the sandalwood (Santalum freyconetanum). The latter has been given every attention, but without success. The failure in this instance is probably due to the tree being parasitic. In its natural environments it is always found in close proximity to other plants. It is highly important that more attention be paid to this valuable and interesting tree, and by assisting nature in reproduction, much might yet be done to restore the at one time leading industry of the Islands. What is wanted is more information connected with the live history of the tree, a careful study of the liking of the sandalwood for its different hosts, and more especially the underground system, since in this portion the plant differs most strikingly from its fellows and is sure to be productive of useful results. When this is done, seeds could be collected and planted amongst the native and exotic kinds that prove the best foster mothers. A ma-

ture tree could be cut to ascertain the age and how many years it will take before the tree will arrive at a saleable age. Samples of the wood could be sent to Washington or London to get the value of same.

Mr. C. A. Baker, Government Botanist, Madras, writes as follows about the Indian sandalwood (Santalum Album). After examining the visible abnormalities above ground, I was led to examine the root. Beginning with seedlings, I was much surprised to find an abundance of connections between their roots and those of other plants. For instance an examination of the root in Lantana and Casuarina plantations, show an inextricable network of sandal root with those of Lantana and Casuarina. There is no doubt that the young sandalwood will if allowed, at once attach itself to foreign plants. Should it be proven that our native species have a liking for the Casuarina (Ironwood) than the planting of Ironwood forests would serve a double purpose and a mixed forest of sandalwood and Ironwood would be a very valuable one.

The latest wood marked report by Denny Mott and Dickson, Limited, London, gives the following prices for Indian Sandalwood, (Santlum Album) Sandalwood logs per ton $75.00 to $150.00. Sandalwood chips per ton $25.00 to $27.50.

Other indigenous species have been tried but most of them are slow growers and the strong winds seem to be hard on them. As the work proceeds towards the reservoirs, the soil becomes better and the winds less severe, so that the trees will make a more rapid growth. Experiments have also been made with a number of pines including the pinus ponderosa recommended by Mr. Griffiths, Expert Forester from the Bureau of Forestry at Washington. As on former occasions the seeds sprouted, and the young plants looked healthy for several months, then they began to decay, and in a short time dwindled

away and died. These experiments plainly show that if any success is going to be made in growing this class of pines a much higher elevation will have to be selected.

There is no doubt that some of the Araucarias would make splendid forest trees for this country and the wood of several is very valuable Araucaria Biduwilii, Araucaria Brasiliensis, Araucaria Cunninghami, Araucaria Excelsa. Each of the above produce valuable wood for different mechanical purposes and are growing well on different parts of the Islands. At Mr. H. P. Baldwin's place on Maui a mixed avenue of the above kinds can be seen, and no finer sample of forest trees can be found on the Islands. There are also some very fine specimens to be found around Honolulu. The drawback to the introducing of those trees as forest trees, is the difficulty of getting good seeds in quantities suitable for forest planting. Several attempts have been made to introduce seeds of the A. Excelsa from Australia but without success; they never arrived in good condition. Success was made however with A. Biduwilii and several hundred plants were distributed from the Government Nursery about four years ago.

Experiments have also been made with Cork Oak but very little can be said about it as the plants are small and growing very slowly. A trial has been made with the Kukui tree in direct planting from seed which promises to be a success. Should this method succeed, a great saving in labor will be gained and blanks in the lower parts of the indigenous forests could be planted in this manner at little expense. The Kukui tree throws up a strong stem from the beginning, which is able to withstand the attack of most insects. Although the wood of this tree is of little value, the making of Kukui nut oil may become an industry, where the trees are plentiful.

One hundred and fifty (150) Ginsing plants were plant-

ed in a bed specially prepared for them in October. The plants have started to sprout, but it will take some time before we can tell whether they are going to be a success in this country or not. In recommending that a trial by contract be made in planting and caring for trees in tracts to be reforested, there is no doubt the men would take more interest in the work and the Hawaiians might be induced to do tree planting in this manner, although they do not seem to care for this kind of work by day labor. The contracts could be made at so much per acre, or so much per thousand trees, at sums varying according to the condition of lands to be planted. Trees could be grown in nurseries and given to the contractors with a plan stating the kind of trees to be used, distance apart, arranging of the different species, and instructions could also be given in the planting and caring for same. The half of contract price could be paid while the work was proceeding and the other half when the trees arrived at a certain height say, four feet, when the contract expires. A clause could also be put in contract to the effect that the land must be clear of lantana when the contract is finished.

The system adopted by the Sugar Planters' Association and the Governor in selecting, setting aside and fencing tracts of land as forest reserves in the different districts of the Islands, is a very important step in the preservation of forests, and although in many instances this will not assure a stand of valuable timber trees without artificial planting, vegetation of some kind will spring up and cover the ground sufficiently to protect the running off and immediate evaporation of the rains by the sun's rays and will in a great manner assist in the regulating of the water supply. After the reserves are selected and fenced, much practical work in propagating and tree

planting will remain to be done where lands have been denuded of trees and the Hilo grass has got a hold.

The raising and planting of trees is expensive work to begin with, but if valuable timber trees are planted the land will increase in value from year to year, and when the trees arrive at maturity a handsome revenue will be forthcoming. The indigenous forests are not in a condition to warrant logging by thinning or clean felling and in fact owing to the small size of most of the trees with the exception of the Koa, they are of little value commercially. The latter has a limited local market which could be easily overstocked. Considerable work has been done on the Nuuanu tract during the period in rooting out lantana which threatened to take possession, and the land had to be gone over several times before it could be got under control. At present the tract is practically clear of the pest, especially the upper part, and by continual watching and rooting out any shook that may come up, it will be easily kept in hand. It is a great pity that the money appropriated by the last Legislature for fifteen men was not available. With that number a far better showing would have been made. The number employed during the year has been eight, this of course, does not include the two men employed at the Nursery, on King Street, and paid out of the Nuuanu appropriation.

In a former report mention is made of addition to laborers' quarters, kitchen to foresters' cottage, repairing road, building bridges and conveying water to quarters.

Owing to the heavy rains, the raising of tender seedlings has been difficult and the station is in need of a propagating house; a canvas house would do and a suitable one might be built for about one hundred dollars. By having the seed boxes protected, would not only be the means of saving many seeds, but much time would be gained in raising the young plants. Trees to the amount

of twenty-eight thousand have been planted during the period, consisting of the following: Koa, Kukui, Monterey Cypress, Wiliwili, Eucalyptus (several species), Australian Blackwood, Japanese Cedar, Ironwood, Halapepe, Swamp Mahogany, Silk Oak, Lama, Turpentine tree, etc. A number of indigenous species are still in beds and showing signs of sprouting.

For painting, whitewashing and repairs to quarters, potting shed, stable, cottage, and new canvas propagating house, seed boxes, tools, etc., would require about three hundred and fifty dollars ($350.00) for the next biennial period.

Respectfully submitted,

DAVID HAUGHS,

Forester.

3 2044 103 119 376